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ERRATA.

Page 36 line 25 for "*elutus*" read "*sacharovi*"
,, 61 ,, 5 ,, "204" read "284"
,, 61 ,, 11 ,, "(*Eutamia*)" read "(*Eutamias*)"
,, 122 ,, 14 ,, "F. Bishop and C. Smith" read "F. C. Bishopp and C. N. Smith"
,, 199 11 lines from end for "Reindeer" read "Red Deer"
,, 200 line 18 for "*truicatae*" read "*turicatae*"
,, 235 ,, 6 ,, "*beguetensis*" read "*benguetensis*"
,, 248 5 lines from end for "58" read "85"
,, 252 16 ,, ,, ,, ,, "JELLISON (W. J.)" read "JELLISON (W. L.)"
,, 272 line 13 for "no. 2" read "no. 6"
,, 301 lines 24 and 28 for "*berberum*" read "*major*"

IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW
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VOL. 24.] [1936.

DA FONSECA (F.). **Notas de acareologia. X. Occorrencia, em S. Paulo, de acarianos transmissores de varias modalidades de febre exanthematica e suas possiveis relações com a rickettsiose neotropica paulista.**—*Mem. Inst. Butantan* **9** pp. 27–41, 28 refs. S. Paulo, 1935. (With a Summary in English.) **XI. Validade da especie e cyclo evolutivo de** *Amblyomma striatum* **Koch, 1844 (Acarina, Ixodidae).**—*T.c.* pp. 43–51, 4 graphs, 6 refs. (Also in French, pp. 53–58.) **XII.** *Eulaelaps vitzthumi*, **sp. n. (Acarina, Laelaptidae).**—*T.c.* pp. 59–64, 4 figs. (Also in German, pp. 65–68.) **XIII. Novas especies sul-americanas de parasitos do genero** *Liponissus* **Kolenati, 1858 (Acarina, Liponissidae).**—*T.c.* pp. 69–98, 17 figs., 8 refs. (Also in English, pp. 99–114.) **XIV.** *Ceratonyssus joaquimi*, **sp. n. (Acarina, Liponissidae) parasita de** *Glossophaga soricina* **(Pallas) de S. Paulo.**—*T.c.* pp. 115–123, 6 figs. (Also in German, pp. 125–130.) **XV. Occorrencia de sub-especie de** *Ixodes ricinus* **(L., 1758) no Estado de S. Paulo (Acarina, Ixodidae).**—*T.c.* pp. 131–135, 2 figs. (With a Summary in English.) **XVI.** *Ixodes amarali*, **sp. n. (Acarina, Ixodidae).**—*T.c.* pp. 137–139, 4 figs. (Also in English, pp. 141–143.) **XVII. Localização, frequencia, distribuição geographica e hospedadores de** *Spelaeorhynchus latus* **Banks, 1917 (Acarina, Spelaeorhynchidae).**—*T.c.* pp. 145–148, 5 refs. (With a Summary in English.)

The first paper records the ticks and mites found in the districts of São Paulo in which São Paulo typhus is endemic [*cf. R.A.E.*, B **21** 67]. *Amblyomma cayennense*, F., seemed the most likely carrier as it is prevalent, attacks man and rodents readily and is easily infected experimentally [**21** 68]. *Rhipicephalus sanguineus*, Latr., *Amblyomma ovale*, Koch, and *A. striatum*, Koch, also appear to merit consideration. *Haemaphysalis leporis-palustris*, Pack., a known vector of Rocky Mountain spotted fever, was common on the wild hare, *Sylvilagus minensis*, which has been found susceptible to infection by *Rickettsia brasiliensis*. Mites found on man included *Liponyssus*

sp., *L. bacoti*, Hirst, and numerous species of *Trombicula*. The rôle of these mites is unknown, but their biology seemed to accord with the epidemiology of São Paulo typhus.

The second paper discusses the status of *Amblyomma striatum*, Koch, which, from characters in bred males, is regarded as specifically distinct from *A. ovale*, Koch. Both these ticks are found in districts in which São Paulo typhus occurs. *A. striatum* completed its life-cycle in 139 days.

In the remaining papers descriptions are given of several new mites from small mammals in Brazil and Argentina, and of the ticks, *Ixodes ricinus aragãoi*, subsp. n., from a deer, *Mazama simplicicornis*, and *I. amarali*, sp. n., from a wild rat, both in Brazil, and the hosts and geographical distribution in Brazil of *Spelaeorhynchus latus*, Banks, found on various bats, are recorded.

Poulton (W. F.). **Annual Report of the Veterinary Department, Uganda, 1934.**—Fol. 36 pp., 1 pl., 2 fldg maps. Entebbe, 1935.

An account is given of the work carried out in 1934 against tsetse flies, particularly *Glossina morsitans*, Westw., in parts of Uganda. In south Ankole, little further clearing was undertaken [*cf. R.A.E.*, B **22** 236], but general observations were made on fly density, and efforts were concentrated on controlling grass burning, a procedure that was rendered difficult by the unusually dry conditions that obtained during the year. The cumulative effect of annual burnings was shown by the more open nature of the uncleared areas [*cf. loc. cit.*], and in certain cleared and burned sections there was a distinct improvement in the growth of grass. In general, the numbers of fly caught in the uncleared areas have continued to decrease, and in the cleared areas they have been reduced almost to nothing, a maximum of 2–3 individuals being taken per net per day by experienced "catchers" in a section where 50 were taken by inexperienced ones in 1931. The concentration of *G. morsitans* in an uncleared area in North Kabiganda was disturbed by increased mining activities, many flies being carried out of the area on cars. Thus observations on fluctuations, which were especially desirable to ascertain whether the outbreak of rinderpest that occurred among buffalo, eland, wart-hog and bush-pig in 1934 had had any effect on the fly, were rendered less valuable, since the reduction in numbers and the increase in female ratio that were noted could not be attributed to any single factor. In this section, the area under cultivation is being extended, and the number of sheep and goats maintained is increasing.

In an appendix (pp. 21–30), R. W. M. Mettam gives a list of ticks and other parasites taken during the year, including *Rhipicephalus neavei*, Warb., on Grant's gazelle, cattle and dik-dik, *R. simpsoni*, Nutt. & Warb., on edible rat, *R. capensis*, Koch, on situtunga, bush-pig, buffalo and edible rat, *Hyalomma aegyptium*, L., on goat, and *Haematopinus bufali*, DeG., on buffalo.

Attempts to re-infect duiker and waterbuck with different strains of *Trypanosoma congolense* and *T. brucei* were unsuccessful. It seems evident that in nature these animals pass through a transient infection with the prevalent trypanosome and thereafter resist further infection ; thus, except for a short period, they are non-infective to flies. This would account for the fact that so few of the animals shot in areas where fly is abundant harbour trypanosomes, although it makes it

difficult to explain the high infection rate (5·5 per cent.) in the belt infested with *G. morsitans* in South Ankole.

On Buvuma Island in Lake Victoria biting flies other than *Glossina* have been regarded as the most important vectors of cattle trypanosomiasis. *G. palpalis*, R.-D., is abundant in the forest on the lake shore, but dissections of large numbers have led to the conclusion that it does not readily transmit *T. congolense*. One example of *G. pallidipes*, Aust., has recently been caught, but owing to its scarcity, this species must at present play a very small part in transmission.

SCHWARDT (H. H.). **Lubricating Oil Emulsion as a Buffalo Gnat Repellent.**—*J. Kans. ent. Soc.* **8** no. 4 p. 141, 1 ref. McPherson, Kans., October 1935.

Efforts to find a cheap and effective repellent for protecting animals against *Simulium* (*Eusimulium*) *pecuarum*, Riley [*cf. R.A.E.*, B **23** 184] have resulted in the recommendation of a cold-mixed oil emulsion, similar to that described by Richardson and Griffin [A **14** 454], made from 3 U.S. quarts lubricating oil emulsified with 1 lb. potash fish oil soap, the resulting thick emulsion being diluted with one part of water. Oil drained from the crank cases of cars may be used if it is allowed to stand for 2 weeks before mixing to allow impurities to settle. Tests carried out in 1932–35 in infested parts of Arkansas have shown that this emulsion is equal or superior to the repellents now in use. It can be made from used oil at about a tenth of the price, and it caused no injury to the mules and cows on which the tests were made. It remains effective for 3–8 hours, depending on the weather conditions and the activity of the animal.

NAJERA ANGULO (L.). **Primer caso de otomiasis por** *Wohlfahrtia magnifica* **descrito en España.** [The first Case of Otomyiasis due to *W. magnifica* described in Spain.]—*Med. Países cálidos* **8** no. 10 pp. 469–474, 4 figs. Madrid, October 1935.

An account is given of a case of infestation of the ear of man by *Wohlfahrtia magnifica*, Schin., in Spain. Over 20 larvae were obtained from the ear, and some of them were reared to the adult stage. The specific characters of this fly are described.

MAZZA (S.) & others. **Investigaciones sobre la enfermedad de Chagas. I-III.** [Investigations on Chagas' Disease. I-III.]—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 25, 25 pp., 17 figs. Buenos Aires, 1935.

Cases of Chagas' disease are recorded from the Argentine Provinces of San Juan and Entre Ríos, where the causal organism, *Trypanosoma* (*Schizotrypanum*) *cruzi*, was found in a high percentage of *Triatoma infestans*, Klug.

KOBAYASHI (H.). **The Influence of Temperature upon the Development of Larvae of** *Musca domestica*.—*Trans. Dynam. Develop.* **10** pp. 385–395, 4 refs. Moscow, 1935. (With a Summary in Russian.)

In continuation of previous work [*R.A.E.*, B **22** 222, etc.], experiments were carried out in Korea over a period of 4 years (1930–33)

on the duration of development of eggs, larvae and pupae of *Musca domestica*, L., at varying temperatures. About 2,600 individuals were used in the observations, and the results are shown in tabular form. The method of rearing the flies is described, the larvae being fed on a by-product of soy beans. The duration of total development was closely connected with the temperature of the air, varying from a minimum of 6 days at 28°C. [82·4°F.] and 31°C. [87·8°F.] to a maximum of 41 days at 13°C. [55·4°F.] and 19°C. [66·2°F.]. The optimum temperature occurred at 25–30°C. [77–86°F.], when the majority of the flies completed development in 7–12 days. Below 10°C. [50°F.] all eggs and larvae succumbed. No case of hibernation was observed during the egg, larval or pupal stages.

NIESCHULZ (O.). **Uebertragungsversuche mit Milzbrand und Bettwanzen** (*Cimex lectularius*). [Transmission Experiments with Anthrax and Bed-bugs.]—*Zbl. Bakt.* (I. Orig.) **135** no. 4–5 pp. 228–229, 3 refs. Jena, 15th November 1935.

In these experiments 100 individuals of *Cimex lectularius*, L., were fed on guineapigs showing numerous anthrax bacilli in the peripheral blood and were transferred within 30 seconds to healthy animals. The latter did not acquire the infection.

DOVE (W. E.) & PARMAN (D. C.). **Screw Worms in the Southeastern States.**—*J. econ. Ent.* **28** no. 5 pp. 765–772, 4 figs. Geneva, N.Y., October 1935.

Infestation of domestic animals by screw-worms attracted attention in Mississippi about 70 and again 35 years ago and caused serious losses in 1933 and 1934, in which years it was observed for the first time in Georgia and northern Florida. In 1934, the outbreak increased rapidly in the south-eastern States and was the most destructive ever recorded [*cf.* *R.A.E.*, B **23** 200, 220]. The species now believed to be primarily concerned is *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), the complete life-cycle of which usually occupies about 3 weeks. The eggs are deposited in masses of 30–100 on moist places in wounds. The larvae hatch in 10–12 hours and feed in clusters, producing cavities in the wounds. After 5–7 days they drop to the ground to pupate in a few hours beneath the soil surface. The pupal period lasts 7–10 days in summer, but may be much prolonged at lower temperatures. The minimum period from oviposition to emergence of adults was found to be 12 days. Pairing occurs 3 days after emergence, and eggs are laid 2–3 days later. When the wounds contain extensive areas of decaying tissues, larvae of *C. macellaria*, F., which breeds in carcasses during the summer months, may also occur in them. In spasmodic infestations that occur in warm periods during the winter, when *C. hominivorax* is normally not very active in areas experiencing killing frosts, *Phormia regina*, Mg., which also usually develops in carcasses, occasionally lays eggs in old wounds or in the soiled wool of sheep. The larvae of *P. regina* are not nearly so destructive to living tissues as *C. hominivorax*. Details of the effect of attack, which frequently results in the death of young animals, are given and the extent of the infestation in Georgia is discussed [**23** 200].

The numbers of animals on which reports were received and (in brackets) the percentages infested in 21 counties in Mississippi in

1934 were : 128,057 cattle (11), 11,605 goats (nearly 7), 6,530 dogs (14), 13,609 horses and mules (9), and 94,173 pigs (12). The highest incidences were reported from unfenced grazing lands along rivers and small tributaries where *Amblyomma maculatum*, Koch, was abundant on different kinds of animals.

Predisposing causes of infestation, which are reviewed, include lack of judgment in timing breeding and performing surgical operations, which should be arranged not to coincide with the period of activity of the flies. Many infestations also occurred in injuries made by the bites of *A. maculatum.*

Reports from Georgia showed that up to 15th September 19·4 per cent. of the infested animals died. This high rate of mortality shows either that the animals were not treated, or that they were improperly treated. Treatment recommended by the U.S. Bureau of Entomology consists of the application of commercial 90 per cent. benzol, after the wound has been cleaned and dried, on a cotton plug that is allowed to remain in place until the fumes have had enough time to kill the larvae, followed by the application, over the cotton plug and around the wound, of pine-tar oil (specific gravity 1·065 to 1·085, acid-free and dehydrated). Both the cotton plug and most of the dead larvae will drop out in a day or two. Further discharge from the wound suggests that further larvae are present and that another application of benzol is required. When the discharge ceases, the wound may be allowed to heal with the aid of daily applications of pine-tar oil, which also repels the flies. Phenols, creosotes, coal tars or roof paints should not be used as they often poison the animals and sometimes kill them. Probing the wound and surgical operations are seldom necessary, and nothing should be done to cause the wound to bleed.

Work carried out in 1933 and 1934 for the instruction of stock breeders in Georgia in the treatment of animals infested with screw-worm is described. This resulted in a reduction of mortality from 19·4 per cent. on 15th September to 12·4 per cent. on 8th November, although the average number of cases per county had risen from 1,178 to 2,852. In Mississippi the number of cases was reduced about 50 per cent. in 3 weeks during the autumn of 1934 by prompt and thorough treatment of infested animals.

King (W. V.) & Bradley (G. H.). **The Screw Worm Outbreak in Florida.**—*J. econ. Ent.* **28** no. 5 pp. 772–777. Geneva, N.Y., October 1935.

Following the first cases in 1933 [*cf.* preceding paper], infestation of domestic animals by screw-worms was reported from all but 10 of the 67 counties of Florida in 1934 and was general in 31, all in the northern part of the State. The percentages of infestation were 13·68 in cattle, 8·72 in horses and mules, 31·17 in pigs, 7·53 in sheep, and 25·03 in goats, but as in a number of the reports the animals that died were not included, the figures should in all probability be higher and the average percentage infestation should be about 22 per cent. rather than 19·28. It is estimated that at least 50,000 animals, including newly born ones, died as a result of screw-worm infestation, a monetary loss of possibly £50,000 in addition to an equal amount to cover the expense of treating cases and the loss due to injury of animals that recovered. By far the greatest losses occurred among

pigs, and the area of general infestation is also the principal pig-producing section of the State. Estimates of the relative frequency of infestation in different types of wounds show that sores in the ear caused by tick bites are an important predisposing factor. *Amblyomma maculatum*, Koch, is believed to be the tick that is chiefly responsible, although *Ixodes scapularis*, Say, which is also more or less prevalent in the State, may be concerned in a certain number of such cases. In addition to the actual treatment of wounds, the prevention of screw-worm attack involves various problems of herd management, such as the provision of an adequate number of pens, chutes and hospital pastures for the convenient handling and treatment of infested or injured animals, developing better pasturage and restricting the ranging of animals to enable all stock to be more frequently inspected, eliminating, so far as possible, the causes of accidental injuries, treating ear tick infestations, and adequately protecting animals after operations or the birth of young. Operations such as marking, dehorning, etc. should be performed in the winter months), and the breeding season should be controlled so that the young are born in late winter or early spring, the period when the screw-worm fly is less active. Unfortunately much of the range stock in Florida overwinters solely on poor natural forage and is more or less unfit for bearing young at this time of year. A large number of new cases occurred in January 1935, after an exceptionally severe frost in December, and in all cases where the fly was identified, it proved to be *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), except one, which contained larvae of *Phormia regina*, Mg. (see preceding paper). It thus appears probable that precautionary measures will be necessary throughout the year in Florida.

ROBINSON (J. M.). **The Screw Worm Situation in Alabama.**—*J. econ. Ent.* **28** no. 5 pp. 777–779, 1 fig. Geneva, N.Y., October 1935.

Infestation of domestic animals by *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), was reported in south-eastern Alabama in 1933. In 1934 the fly first appeared on 1st June in four widely separated counties in the southern third of the State; it continued to spread throughout the south during the summer and in September–November invaded counties in the northern third. No new cases were reported after 13th November when temperatures fell below freezing point. Cattle were most frequently attacked (32,540) followed by pigs (6,912) and sheep (5,642). The most frequently infested parts of the body were the nose, ear, sides of the body, umbilicus and vagina.

BRADLEY (G. H.) & MCNEEL (T. E.). **Mosquito Collections in Florida with the New Jersey Light Trap.**—*J. econ. Ent.* **28** no. 5 pp. 780–786, 3 refs. Geneva, N.Y., October 1935.

During the summer and autumn of 1932, a light-trap for mosquitos, such as is used in New Jersey [*R.A.E.*, B **20** 241], was tested at Oreando, Florida. On 19 nights between 6th July and 10th November hand collections were made and a trap operated over the same periods of time and in the same places. A comparison of the results shows that an average of three less mosquitos was taken in the trap over a 15 minute period and that it caught a larger number of those species

that are less active biters. On the other hand, when it was allowed to run all night, a greater total number of species was taken and included most of the species caught by hand. The commonest mosquitos in the locality were undoubtedly *Mansonia perturbans*, Wlk., and *Anopheles crucians*, Wied., as demonstrated by the trap collections. The all-night collections showed a higher percentage of *A. crucians* and *A. walkeri*, Theo., than the 15-minute collections either by trap or by hand, whereas in the case of *M. perturbans* the opposite results were obtained. This is probably due to the fact that Anophelines showed marked activity throughout the greater part of the night, whereas mosquitos of the genus *Mansonia* are most active early in the night, at which time the 15-minute collections were made. During July, August and September trap collections were made hourly on 10 nights, and the data obtained on *M. perturbans* and *A. crucians* indicate that although there is considerable activity at all hours of the night, in all three months the former was most active during the early part and the latter during the middle part. In readings made hourly on 8 of the 10 nights the temperature ranged from 66 to 81°F. Total numbers of mosquitos taken during hours when each degree of temperature within this range prevailed indicate that temperatures of 70° or above were favourable for mosquito flight. In all, 24,489 mosquitos were taken during 28 all-night trap collections from July to November. The highest average collection occurred in July when the average minimum temperature was also highest. Each succeeding month showed a lower average collection and a lower average minimum temperature. The largest single collection was 3,628 mosquitos on the night of 2nd–3rd September when the minimum temperature was 73°F. It would appear that so long as the minimum temperature was approximately 70° or above there was considerable activity. The numbers of *M. perturbans* gradually decreased during the period, but those of *A. crucians* increased from July to September and decreased suddenly on cool nights in October and November. Rain, wind and bright moonlight for any considerable period were unfavourable to large catches, which were usually made on dark, still nights. A few collections of Anopheline larvae made in close proximity to the trap showed *A. crucians* to be the predominating species, but indicated a much higher relative abundance of *A. quadrimaculatus*, Say, than the trap records. The peak percentages of males of *A. crucians* in the collections appear at approximately monthly intervals (21st July, 18th August, 15th September), and although this may indicate the emergence of new broods, on each of these dates the total numbers of this species entering the trap were much lower than in the catches for the preceding or succeeding weeks.

GUYTON (F. E.). **Pest Mosquito Control in Alabama under C.W.A.**—*J. econ. Ent.* **28** no. 5 pp. 786–790, 2 figs. Geneva, N.Y., October 1935.

A short account is given of drainage work carried out in south-western Alabama during the winter of 1933–34 for the control of mosquitos. The most annoying species is *Aëdes sollicitans*, Wlk., which breeds in marshes with a salinity of 10–15 per cent. The different types of marshes to be dealt with are described, and the shape and size of the drains and their distance from one another is discussed. A

definite relation was observed between the type of vegetation and the number of larvae. Larvae were usually found in areas covered with *Paspalum*, and the areas where they were most numerous were practically always covered with a mixture of *Paspalum* and spike grass; wooded marshes were next in order of preference, followed by pure stands of spike and saw grass. The organisation of the personnel is given together with a summary of the amount and cost of the work carried out. Two inspections during the summer of 1934 showed that its results were satisfactory.

KNOWLTON (G. F.) & ROWE (J. A.). **Handling Mosquitoes on Equine Encephalomyelitis Investigation.**—*J. econ. Ent.* **28** no. 5 pp. 824–829, 4 refs. Geneva, N.Y., October 1935.

A serious outbreak of equine encephalomyelitis occurred in Utah in 1933, and investigations on its transmission were undertaken using various mosquitos, particularly *Aëdes dorsalis*, Mg., *A. nigromaculis*, Ludl., and *A. campestris*, D. & K. In the course of this work, much time was devoted to testing various methods of handling the mosquitos for field and laboratory studies, and in the present paper the apparatus and methods evolved for collecting, storing, feeding and transferring the mosquitos are described in some detail.

The cages used to transport and store the mosquitos were 23 × 18 × 18 inches and covered with white gauze. The upper side of the wooden bottom was almost entirely covered with a cellucotton pad, 2–3 inches thick, enclosed in 30-mesh gauze and soaked with water. The front of the cage consisted of a large celluloid window above a flap of gauze, which allowed mosquitos and guineapigs to be placed in the cage. The bottom pad held about 3 U.S. gals. water and this, with a wet pad 1 inch thick placed on the top, kept the cage humid. A cage of this size accommodates up to 4,000 mosquitos.

The mosquitos fed readily on guineapigs that were clipped, wrapped in a piece of 30-mesh gauze and placed on their sides on the top of the cage in place of the wet cellucotton pad. In other less satisfactory methods the guineapigs were placed in the cage, either secured to racks, or, when partially paralysed, loose but usually with their hind legs hobbled. In larger cages divided across the lower half, they were confined in the smaller section (which was sometimes subdivided to hold an infected guineapig in one half and a healthy one in the other) while the larger section contained a basin of water and growing marsh grass. The mosquitos also fed readily on a mixture consisting of equal proportions of defibrinated horse blood and an emulsion of glycerine and diseased brain. This suspension was placed in animal mesentery bags, which were either laid on the top of the cage or confined between the gauze-covered ends of two celluloid cylinders each containing mosquitos, or a similar cylinder was placed upright in a petri dish on top of a pad $\frac{1}{8}$ inch thick soaked in the suspension. Mosquitos fed readily on these pads. Fed females were transferred to refeeding cages, which were like the field cages but smaller, the most satisfactory size being 16 × 12 × 12 inches. Pads moistened either with water or with sucrose solution were placed on the top. Refeedings were usually begun 3–6 days after the initial infecting feed, using normal guineapigs confined in gauze sacks. Usually about half the mosquitos failed to refeed. Every third day the unfed individuals were transferred in lots

of 50 to celluloid cylinders ($3\frac{1}{2}$ inches long by $1\frac{1}{2}$ inch diameter) and the ends, which were covered with 20-mesh scrim, were pressed alternately to the close-clipped or shaved abdomen of the guineapig previously used in the sack on the top of the cage. By combining these two methods, it was often possible to get 80 to 90 per cent. of the mosquitos to refeed every third day on three or more successive occasions. In some experiments many of the mosquitos would feed almost every day for 6–14 days. Mosquitos survived for 2–5 weeks or sometimes longer. When feedings were made on diseased horses, the best results were obtained by confining the mosquitos in celluloid cylinders 7 inches long by $3\frac{1}{4}$ inches in diameter, the ends of which were covered with 25-mesh bobbinet. About 100 mosquitos were used in each cylinder and 3–5 cylinders on each horse. During excessively hot weather, the feedings were carried out most satisfactorily in shaded places during the late afternoon or early morning. A " cooler " to hold 25 cylinders was constructed from a rectangular box $14 \times 19 \times 21$ inches. Two sides were of wood covered on the inside by a cellucotton pad 2 inches thick. The other two sides were made of double gauze enclosing a 1-inch layer of cellucotton. The bottom, which was raised 3 inches, was made of 50-mesh gauze doubled. When the whole was soaked with water, a high humidity was produced and a proper circulation of air was obtained through the gauze bottom and sides. During hot weather the mosquitos survived much longer when carried in such a container.

Knowlton (G. F.) & Madsen (D. E.). **Mosquitoes annoy Sheep.**—*J. econ. Ent.* **28** no. 5 pp. 834–835. Geneva, N.Y., October 1935.

In a locality in Utah sheep were so severely attacked by mosquitos that the resultant irritation caused them to nibble raw scabby areas on the accessible parts of their bodies. A large flat valley covered principally with moist pasture-land formed an ideal mosquito breeding area. Mosquitos were present in enormous numbers in the mountain meadows examined, and were almost equally abundant in the vegetation along mountain streams, in patches of aspen and even among sage and rabbitbrush. They were extremely numerous and annoying even on the tops of mountains at an elevation of approximately 8,000 ft. *Aëdes dorsalis*, Mg., *A. idahoënsis*, Theo., and *Theobaldia* (*A.*) *inornatus*, Will., were the species concerned.

Tate (H. D.). **The Screw Worm (*Cochliomyia americana* C. & P.) failed to survive the Winter of 1934–35 in Iowa.**—*J. econ. Ent.* **28** no. 5 pp. 835, 837. Geneva, N.Y., October 1935.

Prior to the outbreak that occurred in Iowa in 1934 [*R.A.E.*, B **23** 200], *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) had not apparently been recorded so far north in the United States. It seems probable either that the fly migrated considerably further north than usual during the exceptionally long dry hot summer of 1934 or that it was introduced on infested cattle. To determine whether it could survive the winter in Iowa, an artificially infested sheep was caged out of doors during the latter part of November so that the larvae upon reaching maturity could escape from the wound and pupate normally in the soil. Larvae and pupae were also released on the soil or buried at

various depths under different conditions. Cages were placed over the sites and observations made at frequent intervals throughout the spring and early summer of 1935, but in no case did adults emerge.

KALANDADZE (L.). **Materialien zur Stechmückenfauna Abchasiens (U.d.S.S.R.).** [Contribution to the Mosquito Fauna of Abkhazia (U.S.S.R.). *In Georgian.*]—*Bull. Mus. Géorgie* **8** pp. 45–54, 7 refs. Tiflis, 1935. (With a Summary in German.)

Notes, based on observations in 1931, are given on the distribution in Abkhazia (north-western Georgia) of 12 species of mosquitos (including 4 Anophelines), all of which were recorded in a paper already noticed [*R.A.E.*, B **23** 268].

OTTOLENGHI (D.) & ROSA (A.). **Ricerche sulle varietà di *Anopheles maculipennis* del Ferrarese e di alcune zone limitrofe.** [Investigations on the Varieties of *A. maculipennis* in Ferrara and in some adjoining Zones.]—*Riv. Malariol.* **14** (1) no. 4 pp. 297–324, 3 graphs, 1 map, 11 refs. Rome, 1935. (With a Summary in French.)

From August 1933 to the end of 1934 a study was made in the province of Ferrara and in contiguous parts of Bologna and Ravenna of the distribution of different varieties of *Anopheles maculipennis*, Mg., which were identified by egg characters. It was based on about 16 thousand Anophelines of which about 37 per cent. oviposited. Malaria was absent from some of the districts and endemic in others. The mosquitos found were typical *A. maculipennis*, var. *messeae*, Flni., var. *atroparvus*, van Thiel, *A. sacharovi*, Favr (*elutus*, Edw.), which is regarded as a variety of *A. maculipennis*, *A. hyrcanus* var. *pseudopictus*, Grassi, and *A. claviger*, Mg. (*bifurcatus*, auct.). Eggs of var. *melanoon*, Hackett, were found exceptionally.

In neighbouring and similar localities in a given district the proportional abundance of the varieties of *A. maculipennis* often varied very considerably. This confirms the importance of the immediate environment [*R.A.E.*, B **17** 196] and the need for comprehensive data. There were also differences, in one and the same locality, between the Anophelines in stables and those in dwellings, but very often the latter included the same varieties (even in the same proportions) as the former, though in smaller numbers because of the less attractiveness of the dwelling. In some localities there was a clear coincidence between the presence or absence of *A. sacharovi* and the presence or absence of malaria, but whether a real relation exists is uncertain.

Tests to ascertain the readiness of the different varieties to feed on man were made by exposing the arm to mosquitos that had fed on rabbits the previous day. The percentages that fed were 72 of *atroparvus*, 44 of typical *maculipennis*, 43 of *messeae* and 43 of *A. sacharovi*. All these mosquitos are known to be infectible with malaria, and all actually acquired infection experimentally. The degree of infectibility and aggressiveness remains to be ascertained. The Anophelines captured in dwellings very often contained human blood, even in districts free from malaria and inhabited by varieties that some workers consider of little or no importance.

The races in Ferrara had shorter wings and were therefore generally smaller than the corresponding races in Holland. In early spring the

wings were longer than in summer. As regards the maxillary index, 14·5–15 was the commonest figure for *atroparvus* and 13·5–14 for typical *maculipennis, messeae* and *A. sacharovi*. In various localities the index for *atroparvus* was over 15.

[RUIBINSKIĬ (S. V.)] RYBINSKY (S. B.) & OVCHINNIKOV (M. M.). **Experiments on Rearing *Gambusia* in Ponds near Kiev (Ucraina).**—*Riv. Malariol.* **14** (1) no. 4 pp. 369–376, 22 refs. Rome, 1935.

Following observations on the use of carp and other fish against Anopheline larvae near Kiev [*R.A.E.*, B **23** 86] and on *Gambusia* in the southern Ukraine [**22** 20], experiments were made in 1933–34 in rearing *Gambusia* in ponds near Kiev where the winter is cold. In June 1933, 200 examples were placed in one fishpond and 100 in another, both being shallow, with slowly running water, subaquatic vegetation and steep banks, and well warmed by the sun. In October 25,000 were caught in the first pond and 10,000 in the second. For wintering in natural conditions, some were placed in a small hibernaculum for carp and in 3 ponds, but in April 1934 were found to have died. During the same winter, other fish perished in many waters in the Ukraine owing to insufficient oxygen and other causes, and this might account for the death of *Gambusia*, which was observed to be more sensitive to lack of oxygen than other fish. In the aquarium it throve and was active when the concentration of oxygen was 3 cc. per litre, but died when it was 0·5 cc. Another reason might be insufficient food, the fish having been placed in the ponds on the assumption that they would not feed in winter. Low temperature is a less probable reason, as the temperature in the ponds did not fall below 1°C. [33·8°F.] and was even 3–5°C. [37·4–41°F.] in December and January. In ponds the temperature in summer rose to 30°C. [86°F.] and fell to 10°C. [50°F.], and the lower temperature had no effect on breeding. Examples of *Gambusia* kept for 2 days at 0·5°C. [32·9°F.] were darker in colour than those living at 3–5°C.; at equal temperature those kept in darkness were not so dark as those kept in light.

ARNAUD (J.). **La prophylaxie du paludisme à In Salah (Tidikelt). Essai d'introduction des gambouses dans une oasis saharienne.**—*Arch. Inst. Pasteur Algér.* **13** no. 3 pp. 369–376, 2 pls., 1 map, 1 ref. Algiers, September, 1935.

A description is given of the Oasis of In Salah in the Algerian Sahara, with particular reference to the system of irrigation used for the gardens and large palm groves. From October to April (except in the three winter months when development is retarded) mosquitos breed in large numbers round the edge of the artesian wells, in the storage ponds and irrigation canals, in a large lake into which excess water drains, and in numerous other collections of water. In the hot season (May to October) all water from the wells and springs is utilised for irrigation, the lake dries up, and there is no stagnant water in the palm groves. The military station and the villages are relatively far from the breeding places and separated from the palm groves by high dunes. Moreover, the winds that prevail for the greater part of the year blow from the station towards the palm groves. The only Anopheline recorded is *Anopheles multicolor*, Camb. Anti-larval measures included the construction of drainage canals and the successful establishment of

Gambusia holbrooki in a large number of the mosquito breeding places in this and neighbouring oases.

Collignon (E.). **Observations générales sur la campagne antipaludique de 1934 dans le département d'Alger.**—*Arch. Inst. Pasteur Algér.* **13** no. 3 pp. 377–396, 5 pls., 2 refs. Algiers, September 1935.

Ambialet (R.). **La campagne antipaludique de 1934 dans le département de Constantine.**—*T.c.* pp. 397–409, 5 pls., 3 maps, 4 refs.

Gouget (R.). **La campagne antipaludique de 1934 dans le département d'Oran.**—*T.c.* pp. 410–417, 6 pls.

During 1934 the work carried out for the control of malaria in Algeria was continued and extended [*cf. R.A.E.*, B **22** 62, 186], and a detailed account of it is given in these papers. The results were in most cases satisfactory despite the abnormal weather conditions, which led to an increase in Anopheline breeding [**22** 249]. From observations in the Department of Alger [*cf.* **22** 249], it was concluded that malaria was absent from localities where potential diurnal shelters were free from mosquitos but present in localities where they harboured *Anopheles maculipennis* var. *labranchiae*, Flni. The anti-larval measures included in some cases the utilisation of *Gambusia holbrooki*.

Escomel (E.). **Gastro-entéro-côlite produite par l'ingestion du** *Tyroglyphus farinae.*—*Bull. Soc. Path. exot.* **28** no. 8 pp. 715–717. Paris, 1935.

The author describes a case of acute gastro-entero-colitis, occurring in Lima in November 1934, that was caused by the ingestion of *Tyroglyphus farinae*, DeG. [*cf. R.A.E.*, B **22** 22]. Numerous examples of all stages of this mite were found dead in the stools of the patient. It had been observed ten years previously in enormous numbers on third-grade sugar at Lima, and as it possesses a number of sharp, rigid hairs and secretes toxins, the possible harmful effects of its ingestion were foreseen. The patient had eaten dried raisins, and as two similar cases occurred within a few days, it is suggested that one lot of dried fruit was the probable source of infestation.

Gaud (—) & Nain (—). **Note sur le parasitisme du chien à Rabat par le** *Rhipicephalus sanguineus.*—*Bull. Soc. Path. exot.* **28** no. 8 pp. 718–719. Paris, 1935.

In the course of regular examinations of dogs in Rabat, Morocco, and its environs throughout 1934 with a view to determining the presence in them of the virus of Marseilles fever, information was obtained on the abundance and seasonal prevalence of *Rhipicephalus sanguineus*, Latr. Nearly 9,000 ticks were collected, of which all were *R. sanguineus*, except for 2 examples of *Hyalomma*. In April and May a certain number of nymphs were observed in addition to the adult ticks. From the figures giving the monthly distribution, which are shown in a table, it is concluded that the dogs are infested with *R. sanguineus* throughout the year, but that its numbers are extremely low during December, January and February. The largest average number of ticks per dog (33) was reached in May, when the first cases of Marseilles fever usually occur, but the rate of infestation remained high from April to August. In September it fell abruptly to 0·5 but rose again to 13 in

October, for reasons that were not determined. The number of male ticks was at all times approximately twice that of females.

Tisseuil (J.). **Contribution à l'étude de la papillonite guyanaise.**—*Bull. Soc. Path. exot.* **28** no. 8 pp. 719–721. Paris, 1935.

During 1933–35 a certain amount of information was obtained on the bionomics of the species of *Hylesia* that causes cases of generalised toxaemia in French Guiana [*cf. R.A.E.*, B **6** 196; **21** 63]. Few larvae were found in the mangrove swamps to the south of the town of Cayenne but they were numerous at a distance of about 7 miles on the hills surrounding the lakes that provide the water supply for the town. From April 1933 to April 1935 the moths appeared in the town every few months, but cases of toxaemia did not always follow. The larvae and males, when rubbed on the skin, produced an urticaria that appeared in about a quarter of an hour and lasted a few hours only, and was probably due to the breaking off by the friction of numerous pointed spines and hairs. The generalised toxaemia is caused by the females, which alone are provided with the spines in which the toxin is contained [*cf.* **21** 63].

Gaschen (H.). **Trois cas de hypomélanisme chez les anophèles.**—*Bull. Soc. Path. exot.* **28** no. 8 pp. 747–752, 6 figs., 5 refs. Paris, 1935.

In the maritime zone of the Delta of Tonkin 3 Anophelines were caught in which black spots on the wings were almost or completely absent. One showed a few rare spots that looked like an outline of the design on the wings of *Anopheles vagus*, Dön., or *A. subpictus*, Grassi, but in the other two the wing surface was a uniform light yellow. The author discusses the question of hypomelanism in Anophelines and other insects and reaches the following conclusions. All Anophelines with uncoloured wings hitherto recorded in the literature belong to the group *Pseudomyzomyia*. *A. immaculatus*, James, is an albino form of some species of *Pseudomyzomyia* in the locality of origin (Java and Sumatra). In the present instance, since both *A. vagus* and *A. subpictus* belong to the group of *Pseudomyzomyia*, no definite identification can be made, and the occurrence of cases of albinism in *Pseudomyzomyia* in Tonkin is all that can be recorded. Dissection of pupae at various intervals after pupation showed that the design on the wing of an Anopheline is complete when the adult emerges; accidents in melanogenesis, such as albinism and hypermelanism, appear to occur in the first few hours of the formation of the pupa. Considerable caution should be exercised when basing identifications on spots on the wings and palps. The most reliable basis for identification is a study of the reproductive organs, since these structures appear to be less affected by mutations, whether regressive or progressive.

Monier (H. M.). **Faits nouveaux concernant l'épidémiologie du paludisme à Tananarive.**—*Bull. Soc. Path. exot.* **28** no. 8 pp. 775–778. Paris, 1935.

A malaria survey of Tananarive that has recently been concluded showed that the distribution of adult Anophelines is peculiar. Certain native dwellings and animal shelters situated in the lower town in the vicinity of breeding places are regularly infested. The prevalent winds blow from the north-west and south-west bringing in Anophelines bred in the vast swamps that surround the town except on the east.

These are frequently found in houses on the heights, whereas they are relatively scarce in the intervening sections. Five species of Anophelines have been recorded, *Anopheles funestus*, Giles, and *A. gambiae*, Giles (*costalis*, Theo.), which have been found harbouring oöcysts of malaria, *A. squamosus*, Theo., which showed a marked tendency to invade inhabited houses, *A. coustani*, Lav. (*mauritianus*, Grp.), which definitely preferred stables, cow-sheds and even pig-sties, and *A. pharoensis*, Theo., which has never been found in the adult stage. *Gambusia* has multiplied enormously [*cf. R.A.E.*, B **22** 111], and has practically freed from Anopheline larvae all waters to which it has gained access. At temperatures below 5°C. [41°F.], however, it seeks refuge in deep water, thus leaving the large pools and marshes, which are free from larvae in the hot season, to act during the cold season as permanent reservoirs where the larvae can continue to develop slowly or go into hibernation. There are, moreover, even in the hot weather, many breeding places, such as cultivated and uncultivated rice-fields, drains with running water, and small pools, where *Gambusia* is not found. *A. funestus* and *A. coustani* prefer clear water with a slight current, whereas *A. squamosus* and *A. gambiae* are found chiefly in still water that may even be somewhat turbid. In the dip-wells all species occur, though *A. funestus* appears to avoid aquatic vegetation. Larvae are seldom abundant in shaded breeding places and on cloudy, overcast days they are scarce in dips. Apparently the temperature, which is not generally high, incites the larvae to seek sun and warmth. The high rate of larval mortality has been demonstrated in the laboratory by the small numbers that gave rise to adults even under apparently favourable conditions. Larvae collected on days of rain and of low temperature seldom develop further than the third or fourth instar. Even larvae reared from eggs in the laboratory, which may be more resistant, did not produce adults when kept at outdoor temperatures in water from rice-fields without extra nourishment.

Thus, it is apparent that the breeding of Anophelines in these regions is checked by various meteorological factors, of which the most important are the sudden, great and frequent variations of temperature, which is on the average low and unfavourable for larval development, and the instability of the water collections, which are affected by the abundant precipitation on the high plateaux, the storms at the end of the rainy season and the periodic flooding of the rivers. On the other hand there is the possibility, in an unusually warm or dry season, of an epidemic of malaria, which may be serious, particularly if it is accompanied by a period of famine.

FERRIS (G. F.). **Contributions toward a Monograph of the Sucking Lice. Parts VI–VIII.**—*Stanford Univ. Publ. biol. Sci.* **2** nos. 6–8 pp. 415–634, 87 figs. Stanford Univ., Calif., 1933–35. Price $1.00 each.

In Part VI the author deals with the genus *Haematopinus*, in Part VII with the genera *Echinophthirius*, *Porechinophthirus*, *Antarctophthirus* and *Lepidophthirus*, all of which occur on Pinnipedia, and *Pedicinus*, which is found only on old-world monkeys of the group Cynomorpha, and in Part VIII, which concludes the series [*cf. R.A.E.*, B **8** 71 ; **10** 11 ; **11** 214, 215], with the genera *Pediculus* and *Phthirus*. An appendix contains certain corrections to earlier papers of the series, together with further information on some species that have already

been considered in them. In addition, a list is given of species that have been described prior to 1935 but since the genera to which they belong were treated in this monograph, and that have not already been interpolated.

From a consideration of data on the lice of domestic and wild pigs, the author concludes that it is most practical to recognise but two forms, one including only the lice from *Sus scrofa*, the wild boar of Europe, and the other all lice from domestic and wild Asiatic pigs. He considers the type of Linnaeus' *Haematopinus suis* undoubtedly came from domestic pigs and disagrees with Fahrenholz, who uses the name for the lice of *Sus scrofa*. He does not recognise *H. adventicius*, Neum., and other described forms [*cf.* **22** 206] as distinct from it. As there is thus no name available for the louse of *S. scrofa*, he proposes the name *H. aperis*, sp. n., and gives briefly the characters distinguishing it from *H. suis*.

He considers that the type of *Pedicinus*, Gervais (1844), is *P. longiceps*, Piag. (1880), which Gervais misidentified as *eurygaster*, Burm., when he used it as the type in describing the genus. *P. eurygaster* has been designated as the type of *Phthirpedicinus*. In any case he does not believe either *Phthirpedicinus* or *Neopedicinus* to be generically distinct from *Pedicinus*.

The following are his views concerning the genus *Pediculus*. There are no valid subgenera and only three valid species, *P. humanus*, L., *P. mjöbergi*, Ferris, from New World monkeys (CEBIDAE), and *P. schäffi*, Fahr. [**12** 15] from chimpanzees. *P. capitis*, DeG., and all other forms described from man [*cf.* **9** 19; **12** 190; **14** 171] and some from primates in zoological gardens (*P. friedenthali*, Fahr., and *P. assimilis*, Fahr., from gibbons and *P. consobrinus*, Piag., from *Ateles pentadactylus*) are synonyms of *P. humanus*. With regard to other species [*cf.* **14** 171–172; **15** 208; **20** 39, 220], *P. lobatus*, Fahr., *P. atelophilus*, Ewing, and *P. chapini*, Ewing, together with *P. consobrinus* as wrongly used by Ewing for specimens from *Ateles paniscus* and as the type of the subgenus *Parapediculus*, and probably *P. capitis* form *atelis*, Freund, are synonyms of *P. mjöbergi*, and *P. simiae*, Ewing, the type of the subgenus *Paenipediculus*, is a synonym of *P. schäffi*.

EWING (H. E.). **The Rules of Nomenclature as applied to the Anopluran Genus *Pedicinus* Gervais.**—*Proc. helminth. Soc. Wash.* **2** no. 2 p. 67. Washington, D.C., July 1935.

The author disagrees with Ferris [see preceding abstract] as to the type of *Pedicinus*. He considers that it is *eurygaster*, Burm. (which is also the type of *Phthirpedicinus*) and not *longiceps*, Piag., and also that these two species are generically distinct. He therefore replaces *Phthirpedicinus* by *Pedicinus* and proposes the new generic name *Eupedicinus* (*Pedicinus*, auct.) for the group of species typified by *longiceps*.

PAPERS NOTICED BY TITLE ONLY.

MONTEIRO (J. Lemos). **Tentativas de transmissão experimental do "typho exanthematico" de S. Paulo por percevejos** (*Cimex lectularius*). [Attempts to transmit experimentally S. Paulo "exanthematic Typhus" by Bed-bugs, *C. lectularius*, L.]—*Mem. Inst. Butantan* **9** pp. 1–24, 10 graphs, 4 refs. S. Paulo, 1935. (With a Summary in English.) [*Cf. R.A.E.*, B **23** 148.]

PRADO (A.). **Contribuições ao conhecimento dos culicideos de São Paulo. VI. Notas sobre os mosquitos originarios das taquaras :** *Sabethoides intermedius* (**Lutz**) **e** *Megarhinus bambusicola* **Lutz & Neiva.** [Contributions to the Knowledge of the Mosquitos of S. Paulo. VI. Notes on *S. intermedius* and *M. bambusicola* breeding in Bamboos.]—*Mem. Inst. Butantan* **9** pp. 195–199, 6 figs. S. Paulo, 1935. (With a Summary in English.)

CHRISTOPHERS (R.), HACKETT (L. W.), JAMES (S. P.), MISSIROLI (A.), PITTALUGA (G.), SERGENT (Ed.) & SWELLENGREBEL (N. H.). **Instruccion breve para la identificacion de las variedades de** *Anopheles maculipennis.* [A Brief Guide to the Varieties of *A. maculipennis*, Mg.]—*Med. Países cálidos* **8** no. 10 pp. 484–491, 1 fig., 6 maps. Madrid, October 1935. [See *R.A.E.*, B **23** 152.]

WALCH (E. W.) & WALCH-SORGDRAGER (G. B.). **The Eggs of some Netherlands-Indian Anophelines.**—*Meded. Dienst Volksgezondh. Ned.-Ind.* **24** no. 3 pp. 73–85, 2 pls. Batavia, 1935. [See *R.A.E.*, B **23** 233.]

WALCH (E. W.) & SOESILO (R.). **Malaria Control in the Netherlands Indies** [a review of measures against Anopheline larvae and their results].—*Meded. Dienst. Volksgezondh. Ned.-Ind.* **24** no. 3 pp. 86–94, 6 pls., 4 graphs. Batavia, 1935. [See *R.A.E.*, B **23** 247.]

RAYNAL (J.) & GASCHEN (H.). **Sur les phlébotomes d'Indochine. X.** *Phlebotomus morini* **n. sp.** [description of male from Annam]. —*Bull. Soc. Path. exot.* **28** no. 8 pp. 731–737, 4 figs. Paris, 1935. **XI. Présence de** *Phlebotomus argentipes* **Annandale et Brunetti 1908 au Centre-Annam** [description of female].—*T.c.* pp. 737–742, 3 figs. **XII.** *Phlebotomus tonkinensis* **nov. sp.** [description of female from Tonkin].—*T.c.* pp. 742–747, 3 figs.

THOMSEN (L.). **New Species of New York State Ceratopogonidae.**—*J. N. Y. ent. Soc.* **43** no. 3 pp. 283–297, 2 pls. New York, N.Y., September 1935.

SEN (S. K.). **Mechanism of Feeding in Blood-sucking Diptera** [*Stomoxys calcitrans*, L.].—*Nature* **135** no. 3422 p. 915, 2 figs., 2 refs. London, 1st June 1935.

JOBLING (B.). **Structure of the Proboscis in Blood-sucking Diptera** [*Stomoxys calcitrans*, L.].—*Nature* **136** no. 3451 p. 990, 1 fig., 3 refs. London, 21st December 1935.

THOMPSON (G. B.). **Notes on British Siphonaptera.**—*Ent. mon. Mag.* **71** no. 858 pp. 256–257, 9 refs. London, November 1935. [Corrections to previous paper : *R.A.E.*, B **23** 248.]

BURT (C. E.). **A Review of the Biology and Distribution of the Hour-glass Spider** [*Latrodectus mactans*, F.].—*J. Kans. ent. Soc.* **8** no. 4 pp. 117–130, 23 refs. McPherson, Kans., October 1935.

WILMOT (R. J.). **A Bibliography on the Use of Hydrocyanic Acid Gas as a Fumigant.**—Mimeographed, 110 pp. Gainesville, Florida agric. Exp. Sta., 18th April 1935. [Recd. 30th December 1935.]

WEYER (F.). **Die Rassenfrage bei** ***Culex pipiens*** **in Deutschland.** [The Question of Races in *C. pipiens* in Germany.]—*Z. Parasitenk.* **8** no. 1 pp. 104–115, 2 figs., 15 refs. Berlin, 4th November 1935.

In view of the uncertain result of previous experiments [*R.A.E.*, B **22** 249], the author has continued his investigations as to whether autogenous reproduction in *Culex pipiens*, L., is a hereditary character. In one series of experiments, begun on 30th September 1934, he used individuals of a strain likely to be anautogenous by reason of its mode of hibernation, condition of fat-body and the fact that it was taken in the cellar of a house in "rural surroundings." A fortnight was required to bring the mosquitos out of hibernation. From them, 21 egg batches were obtained and some were divided to give 27 cultures, which were reared under the most diverse conditions of temperature and food. In none of the cultures was there autogenous reproduction, so that the mosquitos could be regarded as an anautogenous strain. In all cases the F_1 generation was eurygamic, the females remaining unfertilised in cages $20 \times 12 \times 10$ ins. except in one culture, which was stenogamic for some unascertained reason. Feeding the larvae on liver, blood or preparations of vertebrate hormones did not influence the mating capacity of the males. It is therefore considered that mating is provoked by certain environmental conditions, such as climate, flight-space, etc. The different reaction to environment (stenogamy or eurygamy) cannot, however, be altered by larval feeding and must be hereditary. These experiments supported the view that the strain used was really an anautogenous one.

As a control for the above experiments the author collected mosquitos in Hamburg on 10th January 1935. Their progeny were stenogamic and autogenous up to the date of writing (about the F_8 generation). He concludes that in these two cases there were two genotypically different strains of *C. pipiens* corresponding to Roubaud's races [**21** 266, etc.] and that the simplest explanation of the doubtful results in his previous work is that the original material was not a pure strain.

In the autogenous race the ovary was nearly always more developed after emergence and before oviposition than in the anautogenous race before a blood-meal, and this character enables the two races to be distinguished. In physiological characteristics the two races behave as described by Roubaud.

HOPKINS (G. H. E.). **Some Observations on the Bionomics of Fleas in East Africa.**—*Parasitology* **27** no. 4 pp. 480–488, 1 ref. Cambridge, 9th November 1935.

A detailed account is given of laboratory experiments carried out in Nairobi in 1929 on the biology of fleas, particularly *Xenopsylla brasiliensis*, Baker, and *X. cheopis*, Roths., under different conditions of constant temperature and relative humidity, *viz.* 15°C. [59°F.] with 60 per cent. humidity, and 20°C. [68°F.] and 30°C. [86°F.] both with 100 per cent. The results were calculated every 24 hours. Only the intermediate set of conditions proved suitable for survival and breeding purposes. A preliminary experiment under these conditions showed that the introduction of a small piece of cloth into the tubes in which the fleas were kept did not significantly affect the results obtained, and in all other experiments this "perch" was omitted. Unfed freshly-emerged males and females of *X. brasiliensis* and *X. cheopis* kept under these same conditions all survived

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for an average of about 21 days. On the other hand, among fleas caught from wild hosts a few moments before the beginning of the experiments, the females of all the species outlived the males under all the conditions tested. The relative suitability of 20°C. and 100 per cent. humidity for oviposition was not apparently due to the greater average length of life of the fleas, since the majority of the eggs were laid on the first day. Under these conditions, 58 per cent. of the females of *X. brasiliensis* and 54 per cent. of those of *X. cheopis* laid eggs, the average number per female being 2·8 and 2·4 respectively. The incubation periods of the eggs of these two species under the same conditions were 9·4 and 8·3 days ; at 30°C. this period was reduced in *X. cheopis* by nearly two days but the number of eggs that hatched was small. No attempt was made to calculate the length of the larval and pupal periods separately, for fear of injuring the insects by handling. The larvae were fed on unsterilised bran or maize meal with a pinch of dried ox blood. The length of the combined periods in *X. brasiliensis* was 55·5 days for the males and 47·4 for the females, the corresponding figures for *X. cheopis* being 50·7 and 45·5. Thus the life-cycle of these two species is on the average approximately 8–9 weeks, with a minimum of 6.

MACLEOD (J.). *Ixodes ricinus* **in relation to its Physical Environment. III. Climate and Reproduction.**—*Parasitology* **27** no. 4 pp. 489–500, 2 figs., 15 refs. Cambridge, 9th November 1935.

The experiments described in this paper, which is the third of a series on the biology of *Ixodes ricinus*, L. [*cf. R.A.E.*, B **23** 136], were carried out to determine the effect of temperature and humidity on the maturation of the gonads, oviposition, and the development of the eggs. When newly gorged females, each with a male attached, were subjected to different combinations of temperature and humidity, the time elapsing before oviposition began was longer at the extreme limits, *viz.* 27·5°C. [81·5°F.] with 100–90 per cent. humidity, 20°C. [68°F.] with 80 per cent. and 14–16°C. [57·2–60·8°F.] with 75 per cent. than at median temperatures and high humidities. At many of the extremes, particularly of humidity, oviposition was abortive, only some few dozen eggs being laid. The shortest period, 8 days, occurred at 22·5°C. [72·5°F.] with 90 and 100 per cent. humidity and 25°C. [77°F.] with 100 per cent. No oviposition occurred at 2–3°C. [35·6–37·4°F.], but when females kept at this temperature for some time were removed to room temperature, oviposition began before the normal time, thus indicating that some degree of development of the ovaries had taken place already. Three females that had begun to lay eggs at room temperature were placed at 2–3°C. ; no eggs were laid for the next three months, but oviposition recommenced a few days after they were returned to room temperature. Thus the absence of egg-laying at the low temperature is due to inhibition of the actual process of oviposition and not merely to the extremely slow rate of maturation of the eggs. In saturated air the average total number of eggs laid was not significantly affected by temperature, but the average time taken to complete oviposition was progressively less and the mean daily average of eggs laid more with increasing temperatures. On the other hand, at 25°C. and humidities of 100, 90 and 80 per cent., the mean length of time taken was more or less

constant and the progressive decrease in the mean daily average of eggs laid was apparently due to a decrease in the total output. Thus a decrease of temperature reduces the rate of oviposition, whereas a decrease in humidity reduces the total number of eggs laid. The manipulation of eggs incident on their enumeration affected their viability, so that the percentage hatching under different conditions could not be determined; but, from experiments in which complete egg clusters were used, it would appear that the lower limit of humidity necessary for development is about 80 per cent. and the upper temperature limit for viability is between 30 and 35°C. [86–95°F.].

As the thermal constant theory cannot be used as a basis for estimating the threshold of development of the tick [**22** 161], an alternative method was devised. This consisted in exposing eggs to two temperatures sufficiently close to each other to obviate the possibility of their requiring, for completion of development, different amounts of heat (expressed in effective day degrees or day degrees over the threshold). The result allows the probable threshold to be obtained by calculation. It apparently lies in the vicinity of 15°C. [59°F.].

To test the effect on the development of the egg of the conditions under which it is laid, gorged females that had begun to oviposit were exposed to different combinations of temperature and humidity for a week, the egg-clusters laid during this period being removed and exposed to various developmental conditions. The results suggest that the rate of development at a particular temperature is not greater in eggs laid under high temperature conditions than in those laid under low temperature conditions. Development under optimum conditions (25°C. and 100 per cent. humidity) was markedly affected by the conditions of humidity under which oviposition took place; it was retarded when humidity was low irrespective of the temperature. Exposure of the ovipositing female to low humidities adversely affects the viability of the eggs produced.

MARSHALL (J. F.) & STALEY (J.). **Some Adult and Larval Characteristics of a British "Autogenous" Strain of *Culex pipiens* L.**—*Parasitology* **27** no. 4 pp. 501–506, 19 refs. Cambridge, 9th November 1935.

The Hampshire (Hayling Island) strain of *Culex pipiens*, L. [*R.A.E.*, B **23** 105], exhibiting all the characteristics of Roubaud's *C. pipiens autogenicus* [**21** 267], including the readiness with which it attacks man, has now been reared through 4 generations on a purely vegetarian diet. A comparison of this strain with anautogenous strains from Hayling Island and Cambridge indicate, in the authors' opinion, that both the adults and larvae of the autogenous race possess definite morphological characteristics by which they may be distinguished. These characteristics, which are discussed in detail, include the lighter colour of the thorax and greater average number of hairs on the ninth tergite of the adults, the relative shortness of the male palps in comparison with the proboscis, the larger average number of branches in each of the four siphonal tufts and the lower siphonal index of the fourth instar larvae, and the greater width of the egg relative to its length. In Britain where *C. pipiens* is usually regarded as being a species that does not attack man, well authenticated instances of its causing widespread annoyance in urban areas

are occasionally recorded, and it is suggested that in these cases an autogenous race is probably concerned.

Pentelow (F. T. K.). **Notes on the Distribution of the Larvae and Pupae of *Simulium* spp. in the River Tees and its Tributaries.**—*Parasitology* **27** no. 4 pp. 543–546, 1 map, 3 refs. Cambridge, 9th November 1935.

The following is substantially the author's summary: The distribution of Simuliid larvae in the River Tees and its main tributaries is discussed. *Simulium monticola*, Friederichs, and *S. variegatum*, Mg., are the predominant species in the upper part of the River, *S. equinum*, L., and *S. reptans* var. *galeratum*, Edw., in the lower part, and *S. ornatum*, Mg., in the Skerne. The causes of these differences in distribution are unknown, but it is suggested that geological structure, the distribution of water plants, and the hardness of the water are some of the important factors concerned.

Buxton (P. A.). **The Effect of *Proteosoma* upon the Survival of *Culex*.**—*Parasitology* **27** no. 4 pp. 547–550, 3 refs. Cambridge, 9th November 1935.

The experiments described were undertaken to determine whether a malaria parasite has any effect on the mosquitos by which it is transmitted. The mosquitos used were *Culex fatigans*, L., reared in the laboratory, and the parasite, a species of *Plasmodium* (*Proteosoma*), probably *P. praecox*. A preliminary experiment, in which newly emerged adults starved for 3 days were allowed to engorge on uninfected birds and subsequently isolated without food at 23°C. [73·4°F.] and 60 per cent. relative humidity, indicated that there was a high degree of individual inconsistency in the time at which death occurred. Three sets of experiments, in which the procedure was similar, were undertaken with mosquitos allowed to engorge on infected and uninfected birds, in the first of which the isolated mosquitos were maintained at 30°C. [86°F.] and 90 per cent. humidity, in the second at the same temperature and 60 per cent. humidity, and in the third at 23°C. [73·4°F.] and 90 per cent. humidity. In the third they were not starved but were given slices of fresh apple for 3 hours daily. The number of deaths that occurred on each successive day in the control and infected groups was noted. If infection with *Proteosoma* had had no effect at all, the difference between the observed and expected figures (as calculated from the controls) should be slight, whereas actually, when measured by Fisher's χ^2 formula, it was considerable. Thus, infection appeared to have a significant effect on the daily deaths. The largest contribution to χ^2 was on the first and second days in the first experiment, the first day in the second experiment and the second, third and seventh days in the third experiment. The increase of deaths on the first day in experiments at 30°C. and on the second day in the one at 23°C. was doubtless due to the invasion of the wall of the midgut by the oökinetes; the increase on the seventh day apparently occurs before the rupture of the sporocysts, but may be due to their growth. Although infection with *Proteosoma* may be supposed to have similar effect in nature, it does not necessarily follow that infection of *Anopheles* with *Plasmodium* would tend to shorten the life of the mosquito.

Tate (P.). **The Larva of *Phaonia mirabilis* Ringdahl, predatory on Mosquito Larvae (Diptera, Anthomyidae).**—*Parasitology* **27** no. 4 pp. 556–560, 8 figs., 5 refs. Cambridge, 9th November 1935.

Eggs of *Phaonia mirabilis*, Ringdahl (*keilini*, Collin) were taken from water in tree holes in Cambridge in May 1931 and July 1933. They hatched 3–4 days after they were collected. The habits of the larvae, which were reared either in water from the tree hole or in tap water containing some pieces of partly submerged rotten wood, are described. They were fed on larvae of *Aëdes geniculatus*, Ol., or *Culex pipiens*, L., and proved to be very voracious, killing more larvae than they ate and, for a few days before pupation, continuing to kill larvae although not feeding. During the last two weeks of larval life, a single larva of *P. mirabilis* destroyed 80 large mosquito larvae. As the larval period lasted about a month, one larva can probably destroy more than 100. Pupation took place between pieces of rotten wood a short distance above the surface of the water. The one female that was obtained emerged after about two weeks. The egg and both mature and immature larvae are described. The very small larvae were remarkable in having all the characters of the typical third instar Cyclorrhaphous larva, and the fact that these characters were found in larvae dissected from the egg showed that their presence was not due to rapid moulting after hatching. There were apparently no moults during the larval period. This precocious development of third-instar characteristics is no doubt correlated with the carnivorous habits of the larvae and the necessity for seizing and devouring prey from the beginning of larval life.

Shute (P. G.). **The Value of the external Spine of the Harpago in identifying Varieties of *Anopheles maculipennis*.**—*Parasitology* **27** no. 4 pp. 561–563, 1 pl., 2 refs. Cambridge, 9th November 1935.

The author has recently examined the external spine of the harpago of *Anopheles sacharovi*, Favr (*elutus*, Edw.) from Albania, the typical *A. maculipennis*, Mg., from northern Rumania, *A. maculipennis* var. *atroparvus*, Van Thiel, and *A. maculipennis* var. *messeae*, Flni., from England and *A. maculipennis* var. *labranchiae*, Flni., from Italy. All the males used had been reared from eggs laid in the laboratory and identified by examination of batches of these eggs. In order to ascertain the characters correctly, the spines should be dissected completely from the surrounding structures, stained, and rolled with pressure when they have been mounted. He concludes that, in general, the shape, length, and other characters of this spine in most varieties are more constant than was at first supposed, and gives a key to the different forms based on the usual findings. The characters vary most in *messeae*, and although this fact would make it difficult to identify single examples caught in nature, the very variability of the spines among males reared from a given batch of eggs would indicate that *messeae* was the form concerned. He considers that, as a general rule, in batches of eggs with atypical surface patterns, the species could be identified by examining the spines of a number of males reared from them. As many as 30 per cent. of batches of eggs may present an atypical surface pattern.

MARSHALL (J. F.) & STALEY (J.). **"Autogenous" Strains of** *Culex pipiens* **(Diptera, Culicidae).**—*Nature* **136** p. 641, 5 refs. London, 19th October 1935.

The suggestion [*R.A.E.*, B **24** 19] that the race of *Culex pipiens*, L., attacking man in residential districts in England is probably autogenous has been confirmed by the rearing of autogenous strains from an engorged female caught in a bedroom in a block of infested flats, and from larvae collected near a row of infested cottages. Autogenous strains from Hayling, London, Hull, France and Greece are now being reared, and a comparison of these strains, and larval and adult specimens from Malta and Hungary, show that they resemble one another in certain respects but differ from the anautogenous strain. Thus Roubaud's original (French) *C. pipiens autogenicus* [*cf.* **21** 267] is but one of a number of autogenous strains, all of which differ markedly from the anautogenous *C. pipiens* and also, to a less but quite obvious extent, from one another. It is therefore suggested that the specific name *domesticus*, Germar, be revived to designate the autogenous group,* varietal names (preferably of geographic import) being appended whenever the recognition of definite morphological or biological differences renders such an action desirable.

MAW (W. A.), WHITEHEAD (W. E.) & BEMONT (L. H.). **The Northern Fowl Mite and its Control.**—*Sci. Agric.* **16** no. 2 pp. 79–84, 1 pl., 1 fig., 4 refs. Ottawa, October 1935.

In Canada during the autumn and winter months *Liponyssus sylviarum*, C. & F., is an injurious pest of adult fowls and causes great inconvenience to those handling them. Its mode of aestivation is unknown, but during the summer it leaves the body of the fowl and is of no further importance until late in the autumn. A list is given of 14 species of wild birds on which it has been found. Purple grackles (*Quisculus quiscula*) appear to be particularly often attacked, but the English sparrow (*Passer domesticus*), which is one of the commonest birds on poultry farms, has only occasionally been found infested and then only lightly. The mites, which are very active, may be found on all parts of a bird but particularly in the region of the vent, in the feathers at the base of the tail and in the hackle feathers on the neck. The eggs are deposited among the barbules of the fluff feathers and hatch in a short time. The life cycle appears to be completed in about 8–12 days [*cf. R.A.E.*, B **18** 21]. The mite breeds on the body and in the feathers of its hosts. It may also be found on dropping boards and roosts and in cracks in the walls of poultry houses, and in these situations may remain for considerable periods after the birds have been removed. In the summer infestation decreases to a marked degree, except on wild birds, but soon after the fowls, apparently free from infestation, are placed in winter quarters that have been vacant all summer and thoroughly cleaned and sprayed, they become inexplicably and severely infested. When young cockerels were artificially infested during the summer with large numbers of mites, the mites soon disappeared and could not be found on the birds or in the house. Male birds are generally more heavily infested than females.

During the cold weather a mixture of one part paradichlorobenzene in two parts vaseline has been found more effective (but more

[* We are informed by the senior author that in a paper now being prepared the name *molestus*, Forskål, is to be revived instead of *domesticus*, Germar.—Ed.]

expensive) than the naphthalene mixture [*cf.* **23** 12]. A number of laboratory tests were carried out in which mites were sprayed (by means of an atomiser) with a variety of proprietary sprays at different concentrations, and allowed to remain for five minutes before being transferred to a dry vial lightly plugged with cotton wool. Counts made after 24 hours showed that practically all gave 100 per cent. mortality and many killed the mites instantaneously. Further tests with a few of the sprays were carried out on mites placed among sawdust and shavings to simulate more closely conditions in poultry houses. These indicate that this is a practical method of checking the breeding of the mite. A drenching spray should be applied in order to penetrate the litter. Where the litter is deep, it should be raked over thoroughly to expose the mites or bring them into contact with the spray and another lighter application should be made. Poultry pens in which the litter was found to be infested were sprayed with tar distillate emulsions at concentrations of 5 and 10 per cent., and no mites were found when the litter was examined 48 hours later.

Peters (H. S.). **Mallophaga carried by Hippoboscids.**—*Ann. Carnegie Mus.* **24** pp. 57–58, 5 refs. Pittsburg, 1935.

A single example of *Lynchia americana*, Leach, infested by 30–40 immature individuals of *Esthiopterum botauri*, Osborn, is recorded from the American egret (*Casmerodius albus egretta*) in Pennsylvania. The usual hosts of this fly are owls and hawks. This is the first record of a species of *Lynchia* transporting lice and of Mallophaga of the genus *Esthiopterum* being carried by Hippoboscids. Moreover this is by far the greatest number of lice that has been recorded on a single fly.

Olson (C.). **The Effect of certain Ectoparasites on the Cellular Elements and Hemoglobin of the Blood of the Domestic Chicken.**—*J. Amer. vet. med. Ass.* **87** no. 5 pp. 559–561, 4 refs. Chicago, Ill., November 1935.

Examination of the blood of two groups of fowls from the same flock, one of which was kept free from ectoparasites for 30 days while the other remained infested with various species of Mallophaga, indicated that heavy infestation with these ectoparasites is not associated with any marked anaemia.

Stiles (G. W.). **Anaplasmosis observed in Wyoming.**—*J. Amer. vet. med. Ass.* **87** no. 5 pp. 579–582, 6 refs. Chicago, Ill., November 1935.

During July and August 1935 cases of anaplasmosis occurred among cattle in two widely separated areas in Wyoming from which cases that were probably due to this disease had been reported in 1932 and 1934. Of ten infected cows on one ranch five died [*cf. R.A.E.*, B **21** 224]. Climatic conditions had been humid and ticks were numerous during the spring of 1935, many being observed on both man and animals during May. Wild animals and birds are abundant and furnish ample sources of nourishment for the ticks; moreover, many cattle, horses, sheep, goats and dogs were found to be infested. Adult ticks taken from a cow that had died of anaplasmosis were all *Dermacentor venustus*, Banks (*andersoni*, Stiles), and experiments are being undertaken with them in connection with anaplasmosis research work. Horseflies, including *Tabanus punctifer*, O. S., are present in Wyoming during the heat of the day in the warmest months of the year, and deer

flies (*Chrysops* spp.) are abundant on low-lying land along streams. Thus Tabanids as well as ticks might be a factor in the transmission of the disease [*cf.* **20** 205; **21** 224].

PHILIP (C. B.), JELLISON (W. L.) & WILKINS (H. F.). **Epizoötic tick-borne Tularaemia in Sheep in Montana.**—*J. Amer. vet. med. Ass.* **86** no. 6 pp. 726–744, 3 figs., 2 refs. Chicago, Ill., June 1935.

During April and May 1934 an epizootic occurred among a flock of 1,320 yearling ewes that were heavily infested with the tick, *Dermacentor venustus*, Banks (*andersoni*, Stiles), in a locality in Montana where jack rabbits and ground squirrels [*Citellus*] were unusually abundant. About 40 per cent. of the sheep were affected and 200 died before the outbreak subsided. Unfed adult ticks were swept in large numbers from vegetation in grazed areas. Jack rabbits were heavily infested with adults of *D. venustus* but harboured few immature ticks; *Haemaphysalis leporis-palustris*, Pack., was practically absent. Immature ticks were also scarce on ground squirrels and adult ticks do not infest them.

Investigations described showed that tularaemia was largely responsible for the epidemic. The presence of *Bacterium tularense* was demonstrated in the tissues of 5 of 6 affected sheep and 2 of 18 jack rabbits and in 12 of 19 samples of ticks from infected sheep and 6 of 24 samples from jack rabbits. Moreover positive agglutination tests were obtained with the sera of 26 of 32 apparently affected sheep. On the other hand the causal organism could not be found in unfed ticks collected from vegetation, and none of the persons engaged in handling the infected animals and ticks became infected, the only human case occurring in a child that had been bitten by many ticks during the spring. Loss of blood due to the feeding of ticks could have been at least a contributory factor in some of the fatal cases. The rapid recovery of affected sheep when the ticks were removed indicated an increased ability to combat the infection, but the removal of ticks may not only have terminated the withdrawal of blood but also some other process such as continued reinfection with *B. tularense*.

It seems probable that the sheep became infected after their arrival from winter feeding grounds, since the disease was present among the local rodents (probably in epizootic proportions), ticks were abundant, and the disease appeared after an interval of approximately 8–10 days. The outbreak came to an end at the beginning of May, and by the 12th the adult tick population had decreased markedly on both animals and vegetation.

ALEXANDER (R. A.) & NEITZ (W. O.). **The Transmission of Louping Ill by Ticks** (*Rhipicephalus appendiculatus*).—*Onderstepoort J. vet. Sci.* **5** no. 1 pp. 15–33, 3 refs. Pretoria, July 1935.

A detailed account is given of further numerous experiments on the transmission of the virus of louping ill by *Rhipicephalus appendiculatus*, Neum. [*cf. R.A.E.*, B **21** 221]. The disease was induced in cattle by the intrathecal injection of the virus, and although no demonstrable reaction followed subcutaneous injection or the feeding of infected nymphs, immune bodies were produced. In a horse infection was produced by the engorgement of nymphs infected as larvae, and the virus was subsequently demonstrated in the blood. The method of rearing the ticks for experimental use is described. The virus was

transmitted from infected to healthy sheep by nymphs infected as larvae and by adults infected as nymphs, but in no case was it demonstrated in the eggs of infected females nor in larvae from such eggs, neither did such larvae transmit it.

To test its ability to survive from the larval through the nymphal to the adult stage, a series of experiments was carried out in which nymphs derived from infected larvae were allowed to engorge on both susceptible and immune sheep, horses and cattle, and were subsequently emulsified and injected into susceptible sheep, or were allowed to moult to the adult stage and were then fed on or injected into susceptible sheep. From the results it is concluded that the nymphs still contained virus after engorging on susceptible sheep and before moulting to adults. Most of the adults from these nymphs were infective, but the nymphs might have cleared themselves and then become re-infected by feeding at a time when the free virus had appeared in the peripheral blood of the host. Most of the adults derived from nymphs that had engorged on immune sheep were capable of transmitting the disease, but as the subcutaneous injection of an emulsion of such adults did not usually induce a reaction, either the titre of the virus was very low, or the ingestion of blood was necessary to "activate" it. Adults derived from nymphs fed on a susceptible horse were apparently uninfective even though the virus was present in the nymphs after engorgement. Most nymphs apparently cleaned themselves while feeding provided that engorgement was completed before the febrile reaction in the host began, *i.e.*, before the appearance of the virus in the peripheral blood. Some nymphs after rapid engorgement contained virus when they detached themselves, but it was not carried to the adult stage. Nymphs that completed engorgement after the febrile reaction had begun acquired a fresh infection and retained it in the adult stage. When the nymphs were fed on an immune horse, the infection was usually lost during and after the moult to the adult stage, although odd individuals transmitted infection as adults. Adults derived from infective nymphs that had engorged on a susceptible calf produced no infection, but adults derived from nymphs engorged on an immune calf in some cases retained their infectivity.

Uninfected nymphs fed on an immune sheep at the same time as infected nymphs gave rise to adults that produced no reaction in sheep, either by injection or feeding. As the antibody content of the serum of immune sheep is high, there appears to be little likelihood of the engorging ticks taking up free virus. Consequently it is believed that an immune animal is of no importance as a reservoir of infection.

From a practical point of view, the work indicates that the disease may be controlled on an infected farm and eventually exterminated by keeping immune animals to serve as hosts for the ticks, in order to hasten development to a succeeding generation, always providing that no susceptible animals are introduced to serve as a potential reservoir of infection.

LLOYD (H. M.). **Notes on the Bionomics of** *Glossina sywnnertoni*, **Austen.**—*Bull. ent. Res.* **26** pt. 4 pp. 439–468, 5 figs., 10 refs. London, December 1935.

A detailed account is given of observations on *Glossina sywnnertoni*, Aust., carried out from December 1930 to July 1932 in the Shinyanga fly belt, Tanganyika Territory.

The following is largely taken from the author's summary : In this gently undulating country four main types of vegetation occur, namely, a plant community on well-drained rises, in which the predominant tree is *Commiphora fischeri* and the grass growth is good ; a plant community on low-lying hard pan areas, in which the main trees are *Lannea humilis* and *C. schimperi* and the grass is poor and patchy ; open savannah wooding with few or no thickets, in which the main trees are species of *Acacia* and the grass growth is good ; and treeless grasslands, with scattered patches of gall *Acacia*, which are swampy during the rainy season and largely waterless during the dry season, when the trees are completely leafless. Game is present in moderate numbers throughout the year, so that there is no lack of food for the fly in any type of vegetation. Most of the flies living in hard pan areas obtain and digest their food there. In the *C. fischeri* association they behave similarly, except that they continue their search for food in a hard pan area if they happen to wander into one and if they find food they may or may not return to the *C. fischeri* area to digest it. If a fly comes across a road or open plain it will patrol this until it finds food and will then return to more sheltered areas to digest it. *G. swynnertoni* breeds mainly in thickets, though pupae are also found under logs or overhanging rocks and in hollows at the bases of trees. It is commonest in hard pan areas, much less common in *C. fischeri* associations, scarce in the types of *Acacia* bush studied at Shinyanga and least common in the open plains. When it is numerous all types of vegetation support a fly-community, except the open plains, but when it is scarce the *C. fischeri* and *Acacia* areas are deserted for the hard pan areas, which are far better suited to its requirements.

The numbers of *G. swynnertoni* reach their maximum during the first month or two of the dry season, which lasts from May to November, and subsequently decrease gradually until they reach their minimum during the short rains (December–January) ; during the short dry season (January or February), they again increase, and remain fairly constant until the end of the long rains (March–April). There is no indication that concentrations of fly in hard pan areas disperse at the end of the rains.

G. swynnertoni appears to find food by sight rather than scent and can cross a clearing 800 yds. wide without the assistance of game. The hungrier the fly the more persistent it is in following man, and males are more persistent than females. Hand-catching of flies on screens for 16 months reduced their numbers, but did not exterminate them from the experimental block, owing to the narrowness of the isolating clearings. Moreover, female flies do not appear very readily to the catchers and breeding was therefore continued. A large rise occurred in the percentage of females.

SIMMONS (S. W.). **The bactericidal Properties of Excretions of the Maggot of** *Lucilia sericata*.—*Bull. ent. Res.* **26** pt. 4 pp. 559–563, 15 refs. London, December 1935.

The experiments described in detail in this paper, which were made without a knowledge of those of W. Robinson [*R.A.E.*, B **23** 305], showed that the excretions of maggots of *Lucilia sericata*, Mg., contain a potent bactericide. The technique for the collection of this material is given. There is evidence that other insects may also produce it [*cf.* **14** 172]. The active principle is not destroyed by autoclaving

at 10 lb. pressure for 20 minutes, and desiccation does not inactivate it. Its bactericidal action was demonstrated by tests on seven species of bacteria, most of which are of aetiological importance in osteomyelitis and other suppurative infections. The lethal action against such organisms seems to be an important factor in the good results obtained with maggot therapy.

HORNBY (H. E.). **East Coast Fever: Trypanosomiasis and Tsetse Fly.**—*Rep. Dep. vet. Sci. Anim. Husb. Tanganyika 1934* pp. 9–13. Dar-es-Salaam, 1935.

At no time during the year and in no part of Tanganyika Territory are native cattle entirely free from ticks, but both the numbers and species vary according to the locality and the time of year. Although information on the transmission of African coast fever is incomplete, it is known that *Rhipicephalus appendiculatus*, Neum., is one of the most important vectors and that none of the bont ticks (*Amblyomma* spp.) can transmit the disease. When the ticks are not on their hosts, they are subject to the effects of environment, but bont ticks are hardy and are found almost everywhere at all times. *Rhipicephalus*, on the other hand, is found all the year round only in comparatively moist cool areas; in other areas it is either absent, or present only at certain seasons. Mountain grassland with its cool moist climate and persistent grass cover provides almost ideal conditions for it, dry open thorn thicket is quite unsuitable at almost any season, and between these two extremes are areas that are suitable or unsuitable according to the season.

African coast fever has been widespread in East Africa from time immemorial, because a proportion of certain local races of cattle are capable of surviving infection if they contract it when young, and in many places an equilibrium has been reached in which a sufficient number of immune cattle exist to support enough ticks to ensure that all calves become infected, and of these a varying percentage survive. The equilibrium is, however, easily upset. If the cattle increase too greatly, they destroy the vegetation cover that is essential to the ticks; the ticks and consequently the disease die out, the cattle increase still further, and the result is over-stocking, soil erosion and periodic starvation of the animals. On the other hand, if the numbers of cattle are reduced abnormally by rinderpest or trypanosomiasis, infected ticks decrease for lack of hosts and calves grow up without having acquired immunity. The grassy environment remains favourable to the ticks, and when infection is re-introduced the disease spreads rapidly. A few decades ago when slave labour was available, much of the coastal belt was more closely settled and cultivated than at present and conditions there were unfavourable for *Glossina* but suitable for the production of herds immune from African coast fever. With the suppression of slavery, coastal plantations were abandoned, and *Glossina* invaded the region and reduced the number of cattle below that necessary for the maintenance of immunity. Thus by 1933 the cattle of the district of Bagamoyo were reduced to small scattered herds and were for the most part susceptible to the disease although they were harbouring large numbers of *Rhipicephalus*. The infection was re-introduced, and in 1933 and 1934 these herds were practically exterminated. This process is taking place all along the coast, and it is doubtful if any cattle will remain after a year or so,

except in places where the herds are protected from fly by large open plains or from African coast fever by dipping. In the Northern Province mortality was high in 1934 because, owing to the severe drought, the only grazing lay in the limited areas of fertile grassland most favourable to ticks. In the two localities in the Central Province where, owing to good grazing, mortality had been particularly high in 1933, it was less severe in 1934 owing to the poorer grazing. With regard to control measures, complete eradication of ticks by systematic dipping is a justifiable aim in certain areas, in other places fuller use should be made of the natural immunising processes, and elsewhere the disease could be kept in check cheaply by the hand removal of ticks.

During 1934 the work of clearing against tsetse fly begun in 1933 in the Mpwapwa region [*cf. R.A.E.*, B **23** 64] was continued, and two strips, each nearly a mile long, now cut across the belt of riverine forest along which *Glossina pallidipes*, Aust., was advancing westward. Throughout the year a large laboratory herd was kept on the farm, no case of trypanosomiasis was certainly contracted there, and not a single fly was seen.

A survey carried out in view of the increasing incidence of trypanosomiasis amongst cattle at Dar-es-Salaam showed that *G. pallidipes* could be taken at almost any point on the outskirts of the town.

EVANS (S. A.). **Routine Work of Mpwapwa Laboratory and some Research Notes.**—*Rep. Dep. vet. Sci. Anim. Husb. Tanganyika 1934* pp. 20–26. Dar-es-Salaam, 1935.

A tick survey carried out among local undipped native stock in Tanganyika Territory during the greater part of 1934 showed that *Rhipicephalus evertsi*, Neum., occurred on cattle and dogs, *R. maculatus*, Neum., *R. neavei*, Warb., *Amblyomma gemma*, Dön., *A. variegatum*, F., *Hyalomma dromedarii*, Koch, and *Dermacentor rhinocerotis*, DeG., on cattle and sheep, *R. simus*, Koch, on cattle, sheep and dogs, *R. appendiculatus*, Neum., *A. lepidum*, Dön., *H. aegyptium*, L., *H. impressum*, Koch, *Boophilus annulatus decoloratus*, Koch, and a species of *Rhipicephalus*, possibly *falcatus*, Neum., on cattle, and *R. sanguineus*, Latr., on dogs.

LEGG (J.). **The Occurrence of Bovine Babesiellosis in Northern Australia.**—*Pamphl. Coun. sci. industr. Res. Aust.* no. 56, 48 pp., 4 pls., 9 charts, 23 refs. Melbourne, 1935.

A detailed account is given of investigations into a form of bovine piroplasmosis different from those already recorded [*R.A.E.*, B **21** 283] that occurs in various parts of the tick-infested area of the east coast region of Australia. Morphologically the causal organism resembles, and is probably identical with, *Piroplasma* (*Babesiella*) *argentinum*; it produces in susceptible cattle a disease that cannot be distinguished clinically from that produced by *P. bigeminum*. *Boophilus annulatus microplus*, Can., is apparently the natural vector, since a strain of the parasite was obtained by feeding larval ticks of this species on a healthy calf. Moreover, outbreaks have been observed among cattle that have been transferred from areas where ticks are scarce to areas where they are more abundant, and several cases occurred among cattle bred in a tick-free district after a relatively short association with cattle infested with ticks.

Ogata (N.). **Die Tsutsugamushi-Krankheit.** *Rickettsia tsutsugamushi.* [Tsutsugamushi Disease.]—*Arch. Schiffs- u. Tropenhyg.* **39** no. 12 pp. 491–505, 8 figs., 3 refs. Leipzig, December 1935.

This is the text of a lecture giving historical, clinical, and aetiological information on tsutsugamushi disease, endemic in Formosa and in some parts of Japan, with notes on laboratory infections, serology, pathological anatomy, the causal agent, *Rickettsia tsutsugamushi* (discovered by the author in 1927), and its vector, *Trombicula akamushi*, Brumpt.

Lewthwaite (R.), Savoor (S. R.) & Hodgkin (E. P.). **Search for Carriers of the Malayan Typhus-like Fevers.**—*Rep. Inst. med. Res. F.M.S. 1934* pp. 11–16. Kuala Lumpur, 1935.

In laboratory experiments in Malaya to test the ability of *Xenopsylla cheopis*, Roths., to act as a vector of the urban type of tropical typhus [*cf. R.A.E.*, B **17** 185], fleas were allowed to feed on infected rats for 15 days. Intraperitoneal inoculations of suspensions of 13 of these fleas into 4 guineapigs produced fever and scrotal swelling in each. Smears of the mid-gut of 7 others kept for 19 days with a normal white mouse showed innumerable intra- and extra-cellular rickettsiae. The remaining 38 were placed in contact with three normal rats. As the infection in rats is unapparent, these animals were killed after 9, 11 and 14 days, respectively, and suspensions of brain and spleen of each inoculated into a pair of guineapigs. In the first case none of the guineapigs reacted, in the second one of the four, and in the third all four. Thus there is little doubt that in nature *X. cheopis* [*cf.* **19** 97] is a vector of urban typhus from rat to rat or to man. In parallel experiments with fleas fed on rats infected with the rural or scrub form of typhus [*cf.* **17** 185], negative results were obtained. Experiments were also undertaken with *Rhipicephalus sanguineus*, Latr., the commonest local tick, and *Dermacentor venustus*, Banks (*andersoni*, Stiles), a tick that is not known to occur in Malaya but which was tested in the hope that it might prove a vector of one or other of the typhus fevers and so enable the virus to be transported to the United States for experiment. Uninfected nymphs or adults were fed (in metal capsules) on guineapigs infected with urban or rural typhus from the first or second day of fever onwards for 3–4 days. They were then kept for periods varying from 2 to 10 weeks, some at room temperature, some at 3–6°C. [37·4–42·8°F.], to enable any ingested virus to multiply and become generalised throughout the tick, and finally allowed to feed on normal guineapigs for 3 days. After removal they were emulsified and injected intraperitoneally into other guineapigs. No clear-cut positive reactions were obtained with either tick with either strain of typhus, so that there was no evidence that the ticks were able to transmit or even acquire the viruses.

Hodgkin (E. P.) & others. **Field Investigations of Malayan Anophelines.**—*Rep. Inst. med. Res. F.M.S. 1934* pp. 24–35. Kuala Lumpur, 1935.

A table shows the Anophelines from various parts of Malaya dissected during 1934. The 16 species are the same as in the previous year [*cf. R.A.E.*, B **23** 61], except that *Anopheles leucosphyrus*, Dön., is replaced by *A. baezai*, Gater. Observations on the rubber estate

[*loc. cit.*] during the first six months of 1934 showed a further decline in the numbers of *A. maculatus*, Theo., and other species also became rather less abundant. Only 6 mosquitos, all *A. maculatus*, were found to be infected with malaria. This species was again most numerous at the end of March and beginning of April, a finding that confirms the previous year's observations on seasonal prevalence and suggests that such a rise and fall in numbers is probably of annual occurrence. The fluctuation is very marked and is doubtless an important factor in the incidence of malaria in areas where this species is the principal vector. Precipitin tests again showed the marked preference of *A. maculatus* for human blood. Further dissections of 11 species of Anophelines trapped on the second rubber estate [*cf.* **23** 60] have revealed further infections in *A. maculatus* and *A. umbrosus*, Theo., the rates now being 0·9 per cent. in both, and a gland infection in a single example of *A. separatus*, Leic. (infection rate 0·3 per cent.), which is here recorded for the first time as a vector of malaria in Malaya. In this area, which is intermediate between the inland hills and the coastal plain, the monthly incidence of *A. maculatus* and *A. umbrosus* seems to differ from the monthly incidence of *A. maculatus* in inland hilly districts (see above) ; the major peak in the incidence of the former occurred in October–November and the minor one in April–May, and although the latter is most numerous in April–May, its numbers did not rise to a second peak in October–November, but reached their lowest point at that time. Infected examples of one or both of these species were found in every month of the year except November. Larvae of 9 of the 11 species trapped were taken in surveys during the year.

In Batu Gajah, trapping, which had been discontinued at the end of June [*cf.* **23** 273], was recommenced in August, owing to a sudden increase in the incidence of malaria, and continued for two nights a week until the end of the year. The same four species again predominated, and it is assumed that *A. barbirostris*, Wulp, was the vector during the outbreak. There is a marked and unexplained disparity between the numbers of adults and larvae caught ; larvae of *A. annularis*, Wulp, *A. philippinensis*, Ludl., *A. subpictus* var. *malayensis*, Hack., and *A. vagus*, Dön., were numerous but the total number of adults of these species caught during the year was only 10, and whereas adults of *A. barbirostris* were caught in large numbers, its larvae were not abundant.

A rather fuller account than the one already noticed [**23** 273] is given of the work carried out in the coastal districts of Selangor.

GREEN (R.). **Laboratory Investigations of Malayan Anophelines.**—*Rep. Inst. med. Res. F.M.S. 1934* pp. 35–42. Kuala Lumpur, 1935.

Many of the results recorded in this report confirm those already noticed [*cf. R.A.E.*, B **23** 60]. Tables show the rate of experimental malaria infection obtained in Malayan Anophelines during 1934 and the numbers that have been infected with various species of *Plasmodium* since 1929. Infection was not obtained in any species that had not been infected in the previous year [*loc. cit.*], additional species tested being *Anopheles baezai*, Gater, and *A. umbrosus*, Theo. A table showing the relative avidity of the various species for human blood [*cf. loc. cit.*] also includes these two additional species ; 26 per cent. of *A. umbrosus*

and none of *A. baezai* fed. The significance of the longevity of Anophelines in the transmission of malaria is discussed and additional data [*cf. loc. cit.*] is given in tables; the maximum longevity ranged from 66 days in *A. maculatus*, Theo., to 36 days in *A. vagus*, Dön., the maximum for *A. hyrcanus* var. *sinensis*, Wied., being 57 days.

ALLAN (W.). **Report of the Medical Officer of Health, Freetown.**—*Rep. med. sanit. Dep. Sierra Leone 1934* pp. 28–32. Freetown, 1935.

This report includes data on routine anti-mosquito measures carried out in Freetown during 1934, including such work as inspection of potential breeding places, oiling, drainage, treatment or felling of trees, etc. Out of 1,289 samples of *Aëdes aegypti*, L., 749 were breeding in tree holes, and the felling of as many old trees as possible is therefore recommended.

[VOLZHENSKIĬ (L. E.).] **Волженский (Л. Е.). Essais de laboratoire avec les produits de schiste comme larvicide.** [*In Russian.*]—*Med. Parasit.* **4** no. 4 pp. 316–320, 2 refs. Moscow, 1935.

An account is given of laboratory experiments in Samara on the possibility of using against mosquitos the products obtainable from the decomposition of schists. The specific gravity and other properties of five products were studied and are briefly discussed. Three of these were used in the tests, *viz.*, a primary tar produced by decomposition of Kashpir schists, an extracted sediment resulting from the sulphonation of schist oils, and a fraction of benzinated tar distilled at 250°C. and over. All these had a specific gravity slightly higher than that of water, and the minimum concentrations at which they had to be used to produce a stable film on the calm surface of water were 20 cc. per sq. m. for the primary tar, 30 cc. for the extracted sediment and 60 cc. for the benzinated fraction.

In toxicity tests, fourth instar larvae and pupae of *Culex* were placed in fresh water with a pH of 7·2 and a temperature of 20°C. [68°F.], and the tested substance was evenly applied to the surface at the rate of 30 cc. per sq. m. In the tests with the primary tar and the benzinated fraction some of the oil was lost by settling to the bottom; to prevent this in the case of the extracted sediment, it was mixed with 50 per cent. petroleum. The mortality was compared with that in untreated water and in water treated with 30 cc. petroleum per sq. m. (a rate that produces a stable film). In untreated water all larvae and pupae survived, and in water treated with petroleum they all died in 80 minutes. In water treated with the primary tar, the solution of extracted sediment in petroleum, and the benzinated fraction the larvae were killed in 25, 30 and 40 minutes, respectively, and the pupae in 30, 40 and 120 minutes. The last high figure is probably due to the fact that the rate of application of the benzinated fraction was only half that necessary to produce a stable film. Pupae that made their way into clean water from the treated part and those that were transferred to fresh water died in a few hours. The addition of the extracted sediment increased the persistence of the film of petroleum on water from 3 days to 10–12. No appreciable changes occurred in the treated waters, the pH in the course of an hour remaining unaltered, except in the case of the extracted sediment when it decreased to 6·8.

Solutions of 15 per cent. by volume of the schist oils in petroleum took nearly as long to kill *Culex* pupae as petroleum alone, showing that this concentration was too low to increase the effect of the latter significantly.

When adults of *Culex* were placed in a closed jar containing water with a small quantity of the primary tar, the very young ones soon became restless and died in about 5–10 minutes, but the older ones were able to resist the effect of exposures for 6–12 hours. To determine whether schist products would act as repellents, four jars of water were placed in the open, the first two close together, and the third and fourth about 5 and 10 ft. away. The water in the first jar was treated with the primary tar at the rate of 10 cc. per sq. m. In 10–15 days the first two jars were free from infestation, the third contained a small number of *Culex* larvae, and the fourth harboured larvae and pupae of *Culex* and also a small number of *Anopheles*. At the end of a month, the two furthermost jars were infested with all stages of mosquitos, the jar containing primary tar was free from infestation, and the one next to it contained about 50 larvae of *Culex*. This showed that even a small quantity of the primary tar will safeguard water from infestation for at least a month.

It is concluded that the effectiveness of oil may be increased by the addition of schist products. It is not advisable, however, to apply them alone since their specific gravity is higher than that of water.

[Beklemishev (V. N.) & Raevskiĭ (G. E.).] **Беклемишев (В. Н.) и Раевский (Г. Е.). On entomological Research concerning Malaria in provincial Institutions. iii. Methods of utilising** *Gambusia* **under Conditions of a given Region.** [*In Russian.*]—*Med. Parasit.* **4** no. 4 pp. 327–328, 1 ref. Moscow, 1935.

This is the third part of an outline of a research programme for subsidiary malaria stations in the Russian Union [*cf. R.A.E.*, B **23** 289] and deals with the utilisation of *Gambusia* against Anopheline larvae in permanent and temporary accumulations of water. Factors to be considered in determining the prospects of establishing *Gambusia* in a given locality are briefly discussed.

King (W. V.) & del Rosario (F.). **The Breeding Habits of** *Anopheles litoralis* **and** *A. indefinitus* **in Salt-water Ponds.**—*Philipp. J. Sci.* **57** no. 3 pp. 329–349, 7 pls., 2 figs., 1 ref. Manila, 1935.

During the year beginning July 1931 periodic collections of Anopheline larvae were made in ponds of salt and brackish water near Manila in which miscellaneous collections had been made during the dry seasons of 1929 and 1931 [*cf. R.A.E.*, B **20** 92]. Descriptions are given of the ponds and of the methods of determining their salt content. Totals of 5,032 larvae of *Anopheles litoralis*, King, and 2,960 larvae of *A. subpictus* var. *indefinitus*, Ludl., were collected; although Culicine larvae were frequently abundant, the only other Anophelines taken were 4 examples of *A. philippinensis*, Ludl. Data are given on the rainfall throughout the year, the algal growths found in the ponds, the variations in salt content and the seasonal prevalence of the two species of Anopheline larvae. The results obtained show that *A. litoralis* is predominant during the dry season when the salt concentration is high and flourishes in water containing more than

3 per cent. salt. During the rainy season the numbers of larvae diminished almost to nil, and after the beginning of the dry season they did not increase to any great extent until the salt content had risen to 2·5–3 per cent. Fairly large numbers of normally active larvae and pupae were recorded on two occasions from water with a salt content as high as 8·8 per cent. Larvae in higher concentrations had a thickening or encrustation of the epidermis. During the rainy season *A. subpictus* var. *indefinitus* becomes predominant ; the breeding of this species is largely limited to brackish or fresh water. When the salt concentration was being gradually increased by evaporation, a few larvae were taken from water containing as much as 3·8 per cent. salt, but in general the tolerance of this species is considerably lower. No breeding took place for two months during the height of the dry season, but larvae reappeared after the beginning of the second rainy season in ponds in which the salt content dropped below 2 per cent.

Broeck (C. T.) & Merrill (M. H.). **Transmission of Equine Encephalomyelitis by** *Aëdes aegypti*.—*Arch. Path.* **20** no. 1 p. 164. Chicago, Ill., July 1935.

The authors briefly record some of the facts brought out in their experiments on the transmission of the virus of equine encephalomyelitis by *Aëdes aegypti*, L. [*cf. R.A.E.*, B **22** 226]. The western strain of the virus has been carried through a series of 15 lots of mosquitos by feeding normal mosquitos on the crushed bodies of infected ones [*cf.* **23** 89], and has reached a dilution far beyond that which could infect if it had not increased in the body of the mosquito. Though *A. aegypti* readily transmits the western strain of the virus, it was only rarely able to transmit the eastern strain after feeding on infected guineapigs and never did so when fed on suspensions of the brains of such guineapigs.

Williams (C. L.) & Dreessen (W. C.). **A Nonflammable Pyrethrum Spray for Use in Airplanes.**—*Publ. Hlth Rep.* **50** no. 41 pp. 1401–1404, 1 ref. Washington, D.C., 11th October 1935.

The concentrated extract of pyrethrum in light oil recently tested as a possible insecticide for use against *Aëdes aegypti*, L., in aeroplanes [*cf. R.A.E.*, B **23** 206] is inflammable. Further experiments were therefore carried out under similar conditions with pyrethrum in various and modified bases or vehicles with the object of developing a non-inflammable mixture. In order to be effective a pyrethrum extract containing 2 per cent. pyrethrins in a carbon tetrachloride base had to be used at the rate of 40–60 cc. per 1,000 cu. ft. and at this rate produced ill effects on human beings, but smaller quantities of mixtures in varying proportions of carbon tetrachloride and refined kerosene each containing approximately 2 per cent. pyrethrins gave satisfactory results. Even when only 1 part kerosene was used to 4 parts carbon tetrachloride, the lethal effect on *A. aegypti* was the same as when the proportion of kerosene was much larger, all the mosquitos being killed by this mixture in 5 minutes when the rate was 5 cc. per 1,000 cu. ft. The various mixtures when used at the rate of 5 or 10 cc. did not cause noticeable irritation or other symptoms in observers remaining in the room for 15 minutes. By ordinary tests the 1 : 4 mixture is non-inflammable but further tests are being carried

out. The possibility of an inflammable residue of oil remaining on exposed surfaces after evaporation of the carbon tetrachloride need hardly be considered, for the absolute amounts to be sprayed are not more than 10 cc. per 1,000 cu. ft. (twice the apparent lethal dose). As the mixtures have a higher specific gravity than oil extracts, they require in air sprayers a slightly higher pressure.

In 4 tests with 5 cc. per 1,000 cu. ft. of a mixture of 1 part kerosene containing 2 per cent. pyrethrins and 4 parts carbon tetrachloride containing no pyrethrins, all mosquitos were killed in 5 minutes. By ordinary tests this mixture was non-inflammable. The pyrethrin content was only 0·4 per cent., but a kerosene extract containing this amount of pyrethrins has been found to be about as effective as one containing 2 per cent.

GINSBURG (J. M.). **Protection from Mosquito Bites in outdoor Gatherings.**—*Science* **82** no. 2134 pp. 490–491, 4 refs. New York, 22nd November 1935.

The results of some 50 tests on areas ranging from a few square yards to 5 acres and used for evening gatherings of from 10 to 2,000 people indicated that such gatherings could be partly or completely protected from *Culex pipiens*, L., *Aëdes vexans*, Mg., *A. sollicitans*, Wlk., and *Mansonia perturbans*, Wlk., by spraying the area with one part of the New Jersey pyrethrum larvicide [*R.A.E.*, B **23** 205] in 10 or 12 parts water without any appreciable injury to vegetation and without discomfort to the people. About half an hour before the gathering takes place, the area, and about 20 feet outside it, should be thoroughly sprayed with a power sprayer developing a pressure of 100 lb. or more and equipped with a spray gun. Both the stock larvicide and the diluted spray should be frequently shaken or mixed. The spray should be applied first as a fine fog directly to the grass, tents, trees, etc. and then directed upward to saturate the atmosphere. At no time should a coarse spray, which may injure vegetation, be applied. One treatment should suffice for 2 hours or even longer, but if necessary the area surrounding the gathering may again be sprayed later in the evening. On small areas a knapsack sprayer or bucket pump, capable of producing a fog spray 10–15 feet high, may be used.

SOPER (F. L.). **Rural and Jungle Yellow Fever—A new Public Health Problem in Colombia.**—4to, 42 pp., 13 figs., 31 refs. Bogotá, 1935.

In this lecture given before the Faculty of Medicine, Bogotá, the author briefly reviews the research work that has been carried out on yellow fever and points out that the disease is now known to exist in four forms, classified respectively as urban and rural yellow fever in the presence of *Aëdes aegypti*, L., and rural and jungle yellow fever in its absence [*cf. R.A.E.*, B **23** 150]. The third form appears where the population of the rural area is sufficient to suggest that the cycle of infection may be man, vector, man, but the fourth occurs in rural and jungle areas and at isolated points along certain river banks where the human population is so low and its movements so slight that the cases would seem to be accidents in an epizootic rather than part of an epidemic. Cases of the last two forms tend to occur among

field workers in places where the clearing of forest or jungle is not complete, and house or family epidemics, although they may occur, are rare. In all outbreaks of yellow fever seen in Colombia during the past five years *A. aegypti* has been absent. A detailed account is given of the series of cases that occurred at Muzo and Caparrapi in the Magdalena Valley and at Restrepo in the Orinoco Valley. In the last-named locality the most common mosquito is *Haemagogus equinus*, Theo., which was found to bite viciously in the field, particularly around the feet and ankles, even when men were actively at work. It would appear that, contrary to observations on urban yellow fever, the danger of contracting the disease is greatest where the human population is lowest but where it is in most intimate contact with jungle life. At least four species of monkeys are common in the forests around Restrepo, and it seems that these and possibly other vertebrates may serve as reservoirs of the disease ; moreover, out of six monkeys subjected to protection tests, four gave positive results [*cf.* **23** 257]. The author points out the impossibility of recommending control measures for the third and fourth forms of the disease until a great deal more is known of their vectors and possible reservoirs.

CAUCHI (J.), BUNKALL (J. D.) & SELLERS (W.). **Mosquito Breeding in Septic Tanks.**—*W. Afr. med. J.* **8** no. 3 pp. 8–9. Lagos, January 1935. [Recd. November 1935.]

Culex nebulosus, Theo., was found breeding in June 1934 in septic tanks of various types in the neighbourhood of Lagos. Experiments undertaken to find practicable preventive measures indicated that all fresh air inlets should be screened to prevent the passage of mosquitos in or out ; effluent pipes should not end in the open air, and, if they discharge into the lagoon, their ends should open under water at all levels of the tide ; and the covers of septic tanks should be made mosquito-tight. For practical purposes the soil pipe appears to be unimportant either as an exit or entrance for mosquitos.

BARBER (M. A.) & RICE (J. B.). **Malaria Studies in Greece. The Relation of Housing to Malaria in certain Villages of East Macedonia.**—*Amer. J. Hyg.* **22** no. 3 pp. 512–538, 4 figs., 5 refs. Baltimore, Md, November 1935.

A detailed account is given of investigations on housing and malaria carried out during 1932–34 in certain plains of eastern Macedonia [*cf. R.A.E.*, B **23** 296].

The following is taken from the authors' discussion and summary : In this region *A. sacharovi*, Favr (*elutus*, Edw.) is probably the only important vector of malaria. *A. superpictus*, Grassi, is rare and *A. maculipennis*, Mg. (both the typical form and var. *messeae*, Flni.), although abundant, shows such a low sporozoite rate that it probably plays a negligible part in transmission. Maturation of ova, biting, choice of hosts, and dispersal in a village, do not seem to differ materially in infected and uninfected examples of *A. sacharovi*. Transmission of malaria to man as shown by the infection of infants may occur widely in a village, even though the density of *A. sacharovi* is much greater in some parts of it, and mere aggregations of this mosquito do not afford a precise guide to the degree of danger in a particular house or part of a village.

The choice of daytime resting places seems to be governed more by such factors as accessibility and nearness to the groups of animals on which the mosquitos have fed in the open than to the degree of temperature or moisture obtaining in them. Degree of darkness guides mosquitos to a daytime resting place and apparently has more influence in effecting change of position within shelters than either temperature or moisture. On the whole, whether within shelters or outside, *A. sacharovi* seems to be little affected by measurable stimuli other than those that lead to food or to protection against sun, rain or wind. These statements apply only to conditions in midsummer, when malaria transmission in this region is at its maximum.

With regard to density, infection with sporozoites, and percentage containing human blood, *A. sacharovi* in old and new houses (which were definitely better built, lighted and ventilated) showed no significant difference constant through two years. In the case of *A. maculipennis*, however, the density and the percentage containing human blood were significantly higher in old houses in both years; the infection with sporozoites was negligible in both types of house. The proportion of infants infected was not significantly higher in old houses in either year.

On the whole the results do not suggest that improvement in housing, other than screening, would be an effective anti-malaria measure in this region. The observations were made in villages in which the old houses were interspersed among the new, but, in view of the behaviour of *A. elutus*, it is doubtful whether the complete renovation of both houses and stables would greatly reduce malaria.

Observations on the nature of blood meals in mosquitos in a village where screening had been carried out indicate that the numbers feeding on man are less than in unscreened localities.

Hackett (L. W.) & Lewis (D. J.). **A new Variety of *Anopheles maculipennis* in southern Europe.**—*Riv. Malariol.* (1) **14** no. 5 pp. 377–383, 1 pl., 6 refs. Rome, 1935. (With a Summary in Italian.)

Anopheles maculipennis var. *subalpinus*, n., is described on characters of the egg, larva and male hypopygium. The egg characters were the only ones by which individuals could be identified. This variety was found in Spain, north-western Italy, Albania, Jugoslavia and Greece. In Albania it was almost always the dominant race of *A. maculipennis*, Mg., in stables near fresh water marshes and oviposited on open sheets of water.

de Benedetti (A.). **La scomparsa dell'arsenico dalla superficie delle acque delarvizzate col verde di Parigi.** [The Disappearance of Arsenic from the Surface of Water dusted with Paris Green against Anopheline Larvae.]—*Riv. Malariol.* (1) **14** no. 5 pp. 438–447. Rome, 1935. (With a Summary in French.)

According to the author's experiments, the disappearance of arsenic from the surface of water dusted with Paris green is not due to the action of moulds or of aquatic micro-organisms. Owing to currents in the water resulting from changes in temperature, the arsenic is buried in the mud at the bottom or on the sides or is carried away from its original position. Other factors include friction by bodies

moving in the water, the ruffling of the water surface by wind, the structure and solubility of the arsenical preparation and its extreme dilution.

SAUTET (J.). **Influence du froid sur les oeufs d'***Anopheles maculipennis*.—*C. R. Soc. Biol.* **120** pp. 412–413, 1 ref. Paris, 1935.

In the course of five years' study on the biology of the various races of *Anopheles maculipennis*, Mg., in Corsica, experiments were carried out to determine the effect of cold on eggs laid by females caught in nature. Eggs laid during the winter by activated hibernating females of typical *A. maculipennis*, *A. maculipennis* var. *labranchiae*, Flni., and *A. sacharovi*, Favr (*elutus*, Edw.) hatched in 6–7 days at the temperature of the laboratory but failed to hatch when kept at 4°C. [39·2 F.] or subjected to this temperature for 6–7 days and then returned to room temperature. Thus it would appear that hibernation in the egg stage is impossible if the periods of cold weather are too prolonged. Eggs laid by active females during the summer hatched rapidly at ordinary temperatures, a variation of some hours corresponding to a range of from 20 to 30°C. [68 to 86°F.] or more. Those kept at 4°C. hatched in 15–25 days, the only increase in temperature being the daily opening of the refrigerator for the purpose of observation. Thus these eggs appear to have a greater vitality than those laid by reactivated hibernating females. This is due either to a hidden interruption of development revealed only by experiment, or to reactivated hibernating females producing premature eggs less capable of surviving unfavourable physical conditions.

KUMM (H. W.). **The Natural Infection of** *Hippelates pallipes* **Loew with the Spirochaetes of Yaws.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 3 pp. 265–272, 2 pls., 1 graph, 5 refs. London, 25th November 1935.

Some of this information on the infection of *Hippelates pallipes*, Lw., with *Spirochaeta* (*Treponema*) *pertenuis* in Jamaica has already been noticed [*cf. R.A.E.*, B **23** 274]. To obtain an idea of what percentage of the flies would become infected after feeding on lesions of yaws that had not been treated in any way, dissections were made of 500 flies captured after they had fed naturally on untreated lesions subsequently shown to contain a reasonable number of actively motile spirochaetes. A total of 71 per cent. were found to be infected. The results showed that *H. pallipes* readily becomes infected under natural conditions from lesions on any part of the body, though it feeds for preference on the perineum or on the lower extremities. For infection to occur the surface of the lesion should be moist, or exuding serum (not pus) freely through cracks in the scab, and the spirochaetes should be abundant.

THEODOR (O.). **A Study on the Reaction to** *Phlebotomus* **Bites with some Remarks on "Harara."**—*Trans. R. Soc. trop. med. Hyg.* **29** no. 3 pp. 273–284, 9 refs. London, 25th November 1935.

The following is taken from the author's summary: The reaction to the bite of *Phlebotomus papatasii*, Scop., has been studied in men who had not previously been exposed to sandflies [*cf. R.A.E.*, B **17**

97]. The course of the reactions obtained confirms former views that a process of sensitisation takes place in a relatively short time, which is later followed by a slow process of de-sensitisation. The view that "harara" of Palestine is due to the bites of *Phlebotomus* was confirmed experimentally, and "harara" is defined as the reaction to their bites at the height of the sensitisation process.

OMORI (N.). **On Fleas attacking Man in the City of Taihoku.** [*In Japanese.*]—*Kagaku no Taiwan* **3** no. 5 pp. 18–22. Taihoku, November 1935.

Nine species of fleas are known in Formosa, of which *Pulex irritans*, L., *Xenopsylla cheopis*, Roths., *Ceratophyllus fasciatus*, Bosc, *Ctenocephalides canis*, Curtis, and *C. felis*, Bch., attack man. *P. irritans* is extremely scarce in Taihoku, but it is common in the mountainous regions. *X. cheopis* and *C. felis* sometimes occur in large numbers in the city, mostly in April and May. *C. felis* is the commonest flea there and is much more often found on dogs than on cats. Petroleum oil emulsion is recommended for spraying against it in dog kennels, under dwelling houses, etc., and naphthalene is effective for its control in Japanese houses.

BONNE (C.). **Over de Crithidien van** *Triatoma rubrofasciatus* **de Geer.**—*Geneesk. Tijdschr. Ned.-Ind.* **75** no. 23 pp. 1954–1955. Batavia, 12th November 1935.

In a previous paper, the author recorded the presence in mice of trypanosomes 2½ and 3½ days after injection of crithidia obtained from *Triatoma rubrofasciata*, DeG., in Java [*R.A.E.*, B **23** 293]. Here he records trypanosomes being found after longer periods, namely 5, 12, 16 and 22 days.

LENT (H.). **Sobre a biologia, systematica e distribuição geographica do** *Psammolestes coreodes* **Bergroth, 1911, encontrado em ninhos de aves no Brasil (Hem. Triatomidae).** [On the Biology, Classification and Geographical Distribution of *P. coreodes* found in Birds' Nests in Brazil.]—*Rev. Ent.* **5** no. 4 pp. 381–396, 6 figs., 22 refs. Rio de Janeiro, 30th November 1935.

Psammolestes coreodes, Bergroth, has been found in Brazil in the nest of a bird, *Phacelodomus rufifrons*. Unlike other Triatomids this species appears normally to feed on birds; in laboratory experiments it refused, even when starved for 12 days, to feed on mammals. Notes are given on its classification and distribution, which appears to extend from Argentina to northern Brazil, and both sexes are described.

MCCULLOCH (R. N.) & HOWE (K. R.). **Jetting and Crutching for the Control of Blowfly Strike. A Comparison at Trangie Experiment Farm.**—*Agric. Gaz. N.S.W.* **46** pt. 10 pp. 569–570, 584, 2 refs. Sydney, 1st October 1935.
Sheep Blowflies.—*T.c.* pp. 579–580, 1 fig.

During the 1934–35 season, an experiment was carried out in New South Wales to test the respective values of jetting and crutching for the protection of a flock of 736 ewes from blowfly strike between

shearings. Blowflies became active in the middle of October. The flock was divided into three similar groups, of 220, 220 and 296 sheep, of which the first was jetted on 17th October with the calcium arsenite mixture (10–10–1–100) [*cf. R.A.E.*, B **22** 17], the second was jetted on 27th October with the calcium arsenite mixture to which Bordeaux mixture (3 lb. copper sulphate, 1 lb. calcium oxide and 35 gals. water) was added to prevent the loss of arsenic from a wet fleece soiled with organic matter through the development of the fungus *Penicillium*, and the third was crutched on 19th October (at which time 54 sheep were seen to have been struck). An examination on 15th November revealed in the first group 29 " touched " and 3 " moderate " strikes, in the second 30 " touched " and 3 " moderate " strikes, and in the third group no strikes. The addition of the Bordeaux mixture had apparently no effect. The first two groups were not dressed but were re-jetted on 24th November using a little more sodium hydroxide in the calcium arsenite mixture (10–10–1·15–100). Flies became less active in December and only 4 sheep (all in group 3) were dressed, 3 on 19th December and 1 on 7th January. By the time of general crutching on 26th February, strike was becoming slightly more obvious and 8, 19 and 14 cases from the three groups respectively were dressed at that time. Owing to the dry conditions during the autumn, blowfly activity was low, and the part of the experiment planned for this season had to be abandoned. The longer wool obtained from the crutching of the jetted sheep is apparently more valuable than the short wool obtained from the sheep crutched twice, even though it is more stained. Jetting with calcium arsenite can be carried out at a cost of ½d. per sheep for labour and materials, whereas crutching after mustering has been done may be said to average 1¼d. per sheep under contract conditions. It is concluded that two jettings protected the sheep during the spring period of fly activity (when strike was at least potentially severe) without the need for hand-dressing, and that the protection afforded by one crutching, carried out as soon as strike became apparent, was only slightly less complete. The data indicate that jetting with calcium arsenite gives at least 4 weeks', and probably 5 weeks', practical protection as compared with 6 weeks' protection following crutching. It is believed that both methods of wholesale treatment are markedly superior to repeated hand-dressing. Crutching at the end of the summer and jetting 6 weeks later were shown in 1934 to give practical protection for 11 weeks.

In the second paper the above experiment is briefly discussed. It is recommended that jetting should be carried out in spring when strike appears and again 4–5 weeks later unless fly activity has ceased. The method of making the calcium arsenite mixture is similar to that already noticed [**22** 124] except that 8 oz. of sodium hydroxide is used instead of 7. The necessity for agitating the mixture and the pressure to be used in applying it are also discussed. It is stated that *Penicillium brevicaule* is known to release an arsenical gas when it develops on moist organic material in contact with many forms of arsenic.

Papers noticed by Title only.

da Costa Lima (A.). **Um novo Siphonaptero** [*Hectopsylla mazzai*, sp. n., from Argentina].—*Rev. med.-cirurg. Brasil* **43** no. 9 pp. 251–252, 4 figs., 4 refs. Rio de Janeiro, September 1935.

Bequaert (J.). **The American Species of** *Lipoptena* **(Diptera, Hippoboscidae).**—*Bull. Brooklyn ent. Soc.* **30** no. 4 p. 170. Lancaster, Pa, October 1935.

Kariya (S.). **Diptera. Tabanidae.** [*In Japanese.*]—*Cat. Jap. Ins.* Fasc. **6** 23 pp. Tokyo, May 1935.

Haslinger (F.). **Ueber den Geschmacksinn von** *Calliphora erythrocephala* **Meigen und über die Verwertung von Zuckern und Zuckeralkoholen durch diese Fliege.** [On the Gustatory Sense of *C. erythrocephala* and the utilisation of Sugars and Sugar Alcohols by this Fly.]—*Z. vergl. Physiol.* **22** Heft 5 pp. 614–640, 23 figs., 24 refs. Berlin, 21st December 1935.

Miller (W. C.). **Some Observations on the Prevention of Blow-fly Attack in Sheep.**—*Vet. J.* **91** no. 11 pp. 464–469, 1 diagr., 1 ref. London, November 1935. [See *R.A.E.*, B **23** 241.]

MacDougall (R. S.). **Ox Warble Flies** [a summary of data on *Hypoderma* spp. infesting Cattle].—*Vet. J.* **91** no. 11 pp. 472–481, 2 pls., 3 figs., 3 refs. London, November 1935. [See *R.A.E.*, B **23** 224.]

Iyengar (M. O. T.). **Eggs of** *Ficalbia minima*, **Theo., and Notes on Breeding Habits of three Species of** *Ficalbia* [in India].—*Bull. ent. Res.* **26** pt. 4 pp. 423–425, 4 figs. London, December 1935. [*Cf. R.A.E.*, B **23** 238.]

Marshall (J. F.) & Staley (J.). **Generic and Subgeneric Differences in the Mouth-parts of Male Mosquitos.**—*Bull. ent. Res.* **26** pt. 4 pp. 531–532, 1 fig. London, December 1935.

Knowlton (G. F.) & Rowe (J. A.). **Notes on Utah Mosquitoes.**—*Proc. Utah Acad. Sci.* **12** pp. 245–247, 7 refs. Provo, 1935.

da Costa Lima (A.). **Sobre as especies de** *Orthopodomyia* **encontradas no Brasil (Diptera, Culicidae)** [including two new species].—*Rev. med.-cirurg. Brasil* **43** no. 6 pp. 175–179, 2 pls. Rio de Janeiro, June 1935.

Rondelli (M. T.). **Ixodoidea del Fezzan e della Somalia italiana raccolti dal prof. E. Zavattari e dal prof. C. Tedeschi.** [Ticks of Fezzan and Italian Somaliland collected by Prof. E. Zavattari and Prof. C. Tedeschi (including 3 new species and 1 new subspecies).]—*Atti Soc. ital. Sci. nat.* **74** no. 3 pp. 239–252, 6 figs., 10 refs. Milan, October 1935.

Schulze (P.). **Zur Zeckenfauna Formosas.** [On the Tick Fauna of Formosa (including a new species and a new subspecies).]—*Zool. Anz.* **112** no. 9–10 pp. 233–237, 2 figs., 8 refs. Leipzig, 1st December 1935.

Kulikoff (N. S.). **Die geographische Verbreitung der Zecke** *Rhipicephalus rossicus* **Yakimoff und Kohl-Yakimoff, 1911.** [The geographical Distribution of the Tick, *R. rossicus*.]—*Z. Parasitenk.* **8** no. 2 pp. 241–242, 1 ref. Berlin, 13th December 1935.

Macías y Macías (F.). **Otro caso de otomiasis por** *Wohlfahrtia magnifica* **(Schiner, 1862).** [Another Case of Otomyiasis due to *W. magnifica*.]—*Med. Países cálidos* **8** no. 11 pp. 538–541, 11 refs. Madrid, November 1935.

In this second case [*cf. R.A.E.*, B **24** 3], 3 third-instar larvae of *Wohlfahrtia magnifica*, Schin., were found in the ear of a child in Spain.

Salem (H. H.). **The Egyptian Species of the Genus** *Sarcophaga* **(Dipt. Tachinidae).**—*Publ. Fac. Med. Egypt. Univ.* no. 5, iv + 61 pp., 19 pls., 4 pp. refs. Cairo, 1935.

The taxonomy, characters (particularly of the male terminalia) and habits of the genus *Sarcophaga* are discussed. Descriptions are given of 15 species and 3 varieties from Egypt (of which 5 species and 1 variety are new), together with keys to the males based on external characters and on terminalia. The author has a specimen of *S. dux*, Thoms., stated to have been reared from larvae infesting the human ear in Egypt and has himself reared *S. hirtipes*, Wied., from larvae from a case of human intestinal myiasis.

Platt (K. F.) & Scott (J. A.). **A Case of Aural Myiasis.**—*Brit. med. J.* no. 3909 pp. 1099–1100, 2 refs. London, 7th December 1935.

A case is recorded of 31 larvae of *Lucilia sericata*, Mg., being removed from the ear of a farm labourer in England in 1935. This is the first record of such infestation in Britain.

Ratcliffe (F. N.). **Observations on the Sheep Blowfly** (*Lucilia sericata* **Meig.**) **in Scotland.**—*Ann. appl. Biol.* **22** no. 4 pp. 742–753, 2 figs., 3 refs. Cambridge, November 1935.

An account is given of some of the experiments on sheep blowflies, chiefly *Lucilia sericata*, Mg., that have been undertaken at Aberdeen [*cf. R.A.E.*, B **22** 183]. Only one doubtful case of strike by *Calliphora erythrocephala*, Mg., was recorded. Experiments showed that the pupae of this species are unable to withstand a temperature of 90°F. or the larvae one 4–5° lower. Thus the larvae cannot develop in contact with the skin of living sheep, especially in those parts (the breech and under the legs) where moisture conditions are usually most suitable but where the temperature approximates blood heat (102°F.). They will only find a suitable temperature in the fleece at some distance from the skin, but nourishment in the form of serous ooze will not be available there until some time after the larvae of *Lucilia sericata* have begun to feed, a fact that lends support to the suggestion that in Britain *C. erythrocephala* behaves as a "secondary" fly. On the other hand Scottish shepherds believe that it is responsible for the strikes in June, *L. sericata* appearing later in the season, and it is undoubtedly attracted to scouring ewes, which are the sheep most often attacked in the early part of the season.

The method of rearing *L. sericata* for observations is briefly described. Four females laid more than 6,743 eggs in 22 days during September. The average number of batches per female was 9, the

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average interval of 2–3 days between ovipositions representing the period necessary for the maturation of more eggs. The conditions of the experiment were probably far more favourable than those in nature, and the egg-laying capacity of the fly is therefore probably exaggerated [*cf.* **22** 184]. The process of oviposition, which may last 30 minutes, was preceded by more than half an hour's careful exploration of the meat. Examination of struck sheep showed that ovipositing flies will often force their way to within half an inch of the skin in the middle of a staple. Larvae fed for 6–9 days at room temperature (55–72°F. during August and September), 3–4 days at 80°F., and 2–3 days at 90°F. Individual variation in the length of the prepupal period was so great that no conclusions could be drawn from a comparison of different batches at different temperatures. At room temperature, the dormant period tended to be so long that an insignificant number of pupations was recorded among hundreds of larvae bred. Larvae that had been dormant for some time pupated rapidly if placed in an incubator, and the effect of the sudden rise in temperature apparently increased with the length of the preceding dormant period. To determine whether pupae as well as dormant larvae could survive the winter [*cf.* **22** 132], pupae in jars half filled with damp cork packing were kept at 34–50°F. from 11th November to the following April, when they were all found to be dead. Dormant larvae survived under the same conditions and almost all had pupated by 27th June. Observations indicate that a temperature of 55°F. is necessary to induce pupation. The approximate pupal periods were 3 weeks at room temperatures, 6–7 days at 80°F. and 5–6 days at 90°F.

Daily records of the sheep struck in a flock were kept in 1933 and 1934 and the results are shown in graphs. The early strikes, in June, were almost entirely confined to ewes, chiefly to those that were scouring, and the site of attack was the breech and root of the tail. At this time the lambs have not a sufficiently thick fleece to attract the fly. After the ewes are clipped at the end of June, they are practically immune until towards the end of the season, when they begin to be struck again, although in much smaller numbers than the lambs. In these late cases, the strike is usually on the back or body in both lambs and ewes. The lambs are dipped just after the ewes are clipped, so that they are relatively free from strike at the beginning of July. The approximate percentages of sheep struck were 34 during 1933 and 27 during 1934. The percentage of ewes struck was about 18 in each year, but the percentages of lambs were 47 and 36 respectively. The number of re-strikes was small, but as their number depends on the care taken in treatment, they may be a serious problem where dressing is ignored.

Carew (J.). **Blowfly Strike in Sheep. Methods of Control.**—*Qd agric. J.* **44** pt. 4 pp. 419–424, 4 figs. Brisbane, 1st October 1935.

The author reviews various methods of treating sheep for the control of blowfly attack in Australia [*cf. R.A.E.*, B **22** 209; **23** 292, 294]. They include a cage fixed in a race over a dipping bath and tipped by means of a lever so that the hindquarters of the sheep are dipped in a mixture consisting of 3–4 lb. arsenic to 100 gals. water (which is approximately half the strength used for jetting and twice that used

for dipping). It is claimed that maggots are destroyed when the sheep are dipped and that many flies are subsequently killed by sucking the poisonous mixture from the wool.

Lo (Ching-sheng). **The Warble Fly Menace.**—*Ent. & Phytopath.* **3** no. 32 pp. 638–646, 3 figs., 5 refs. Hangchow, 11th November 1935.

No adults of *Hypoderma* have been caught in the Provinces of Kiangsu and Chekiang during the past ten years, and the author has not observed any warbles in cattle at a dairy farm in Nanking during the past 13 years, so that these flies cannot be considered a pest of cattle or buffalos in central China. On the other hand, it has been reported from Shanghai that during the routine inspection of hides, 3–5 per cent. of the buffalo hides and 5–10 per cent. or more of the ox hides are damaged by warbles. These hides usually come from Sian (Shensi). Thus warble flies are present in China and are more prevalent in the north-western Provinces. Animals recently imported from America have been found infested in Soochow, where the fly was identified as *Hypoderma lineatum*, Vill., and Nanking, although local dairymen have not observed infestation in locally bred animals. The economic importance of warble flies is discussed, and the estimated losses on exported raw hides for the years 1930–34 are shown in a table. A brief summary of the life-history of *H. lineatum* is quoted from the literature [*R.A.E.*, B **14** 163], and various control measures are suggested [*cf.* **14** 164 ; **15** 8].

Stevenson (L.). **Warble Fly Control in Ontario.**—*Rep. ent. Soc. Ont. 1934* **65** pp. 81–83. Toronto, 1935.

A brief account is given of the results of successful campaigns that have been carried out in Ontario in recent years against *Hypoderma lineatum*, Vill., and *H. bovis*, DeG., in cattle, using compounds containing derris. More than half a million cattle were treated during 1934.

Twinn (C. R.). **A Summary of Insect Conditions in Canada in 1934.**—*Rep. ent. Soc. Ont. 1934* **65** pp. 112–128, 1 ref. Toronto, 1935.

These notes include records of a number of insects attacking man and animals in Canada during 1934. *Pulex irritans*, L., was recorded for the first time from the Province of Quebec. Larvae obtained from the ear of a man in Saskatchewan proved to be those of *Sarcophaga cooleyi*, Parker.

Thomsen (M.). **The Problem of Fly Control.**—*L.o.N., Hlth Org., C.H./Hyg.rur./E.H.4* 17 pp. multigraph, 13 refs. Geneva, 3rd April 1935. [Recd. December 1935.]

A brief account is given of the manner in which the problem of fly control is being dealt with in Denmark, where the predominant fly in houses, stables and sheds is *Musca domestica*, L. Most of the information has been noticed from a previous report [*cf. R.A.E.*, B **22** 230]. In June 1934, 79,700 larvae of *M. domestica* developed in 15 days in 15 heaps of uncovered pig manure, whereas none developed

in 15 heaps that had been carefully covered with a layer of cow dung. In 1934 this method of control was adopted on a number of farms, and good results were obtained wherever it was thoroughly carried out, especially when animal sheds were frequently cleaned. At times when cow manure is not available it is suggested that seaweed or peat moss might be used as a substitute. The method of covering the pig manure with tarpaulins was tested on a number of farms in 1933 and 1934 and excellent results were obtained, although rather more care is required than with cow dung. The paper concludes with a discussion of the methods of fly control used in other countries and a dissertation of some length on the general principles involved. The author considers that the quantity of breeding material available is the chief factor in determining the numbers of *M. domestica*.

Lörincz (F.) & Makara (G.). **Observations and Experiments on Fly Control and the Biology of the House Fly.**—*L.o.N., Hlth Org., C.H./Hyg.rur./E.H.5* 13 pp. multigraph. Geneva, 23rd April 1935. [Recd. December 1935.]

A detailed account is given of investigations carried out in Hungary since 1933 on the bionomics and control of house-flies [*Musca domestica*, L.] on farms. Experiments in which different types of manure taken from a farmyard were placed in boxes and covered with fly traps and in which different kinds of manure were exposed to infestation in boxes for 48 hours before being covered, indicated that pig dung was the preferred breeding medium [*cf. R.A.E.*, B **22** 230], although in the latter series some flies emerged in each experiment, even in those in which fresh cow manure was used. Increasing numbers of eggs were placed in the same amount of pig, horse and cow manure in order to determine the maximum numbers of flies obtainable in each case. It was found that the size as well as the numbers of flies that emerge must be taken into account. The weight of flies obtained by overcharging to the maximum a given weight of a certain kind of manure does not exceed the total weight of the smaller number of full-sized flies obtained under the most favourable conditions. Ultimately the weight of the pupae was determined, as it could be ascertained more easily and accurately than the weight of the flies. Females emerging from pupae weighing 15 mg. still showed normal egg production, and this weight was therefore taken as the average normal weight. About 120 gm. pupae (corresponding to 7,500 [*sic*, ? 8,000] normal flies if pupae weigh 15 mg.) were obtained from 1 kg. fresh pig manure; 15,000 flies are obtainable as an absolute maximum but they are smaller. Pupae weighing 75 gm. (corresponding to about 5,000 normal flies and an absolute maximum of about 8,000) are obtainable from 1 kg. fresh horse manure, and about 2,000 normal flies with about 7,000 absolute maximum from the same quantity of fresh cow dung.

In further experiments with dung at 20°C. [68°F.] and optimum humidity, the fly-breeding capacity of the manure was found to diminish with the progress of fermentation, owing doubtless to the decrease of suitable and sufficient food. Owing to its slower rate of decomposition or the presence of more abundant food material, the fly-breeding capacity of pig manure remains almost unchanged for 2–3 weeks, whereas in cow and horse manure the capacity is considerably reduced in the second week. In the laboratory human faeces

showed the same qualities as pig dung, while sheep dung was similar to cow dung. Sometimes flies breed in large numbers in wet refuse from kitchens, but only for about 7–10 days. Any decomposing material is suitable for fly breeding ; nearly full-sized flies were bred from tobacco powder. The further advanced the state of fermentation the more prolonged the duration of the larval stage ; in fresh manure it lasts 4–5 days, whereas in old dung it may last 1–2 months.

The larvae appeared to be very resistant to extreme changes in heat and cold but were much more sensitive to quality and especially quantity of food. If too many flies were bred in a medium of a certain weight and quality, after a time only smaller flies were obtained. The smallest pupa-weight under these conditions was 4 mg. ; dwarf flies still emerged from these pupae but were incapable of laying eggs. The largest flies emerged from pupae weighing 25 mg. The decrease in size of the flies resulted in a proportionate decrease in the number of eggs laid in a month. These findings indicate that if the flies are prevented from breeding in preferred media, the importance of those breeding in less suitable material will be lowered by their diminished fertility.

When gravid females were confined in cages with various breeding materials including manure, the latter was almost invariably selected. The state of humidity and decomposition influenced the choice. Fresh horse manure was the preferred medium, although fresh pig manure was selected almost as often. In experiments with various aromatic materials, ammonium carbonate was the most attractive. When material treated with ammonium carbonate was placed in the cage with fresh manure as a control, the former was almost always selected. The number of eggs laid in 24 hours in an egg trap with manure containing ammonia was 6,000 whereas only 500–600 were taken in a trap containing fresh dung. The degree of decomposition that, owing to the production of odoriferous substances, attracts flies most, is usually the most favourable for the development of the larvae. On the other hand, the surface of the most suitable breeding medium, pig dung, soon hardens into a crust, and the odours diminish in intensity, whereas materials of loose porous structure such as fresh horse dung remain permeable to air even though they dry faster. Thus the fact that the odour of horse dung is effective for a greater distance over a longer time partly explains why it has been considered the principal source of flies, and why it was preferred by gravid females even in the presence of material more suitable for breeding.

The number of eggs laid at one time by a normal-sized fly was 120, and at 18°C. [64·4°F.] eggs were deposited every 10–14 days, or 3–5 times in the life of each fly. The incubation period lasted a week at 8–10°C. [46·4–50°F.], 22 hours at 20°C. [68°F.], 15 hours at 30°C. [86°F.], and 12 hours at 40°C. [104°F.]. Only larvae less than 36 hours old are susceptible to adverse influences ; older larvae and pupae are very resistant. In Hungary at least flies do not hibernate in the pupal stage.

Various methods for treating manure on farms for the control of flies, including that of Thomsen [*cf. loc. cit.*], are discussed ; the authors consider that none of them would be suitable under the conditions of Hungarian villages, and are inclined to believe that special manure bins would ultimately be most satisfactory. A brief outline is given of the problems that are now in the course of investigation.

SERGENT is preceded by:

BOYD (J. S. K.). **Fevers of the Typhus Group in India. An Analysis of One Hundred and Ten Cases reported in 1934.**—*J. R. Army med. Cps* **65** nos. 5–6 pp. 289–305, 361–367, 14 refs. London, November-December 1935.

An analysis is made of the case sheets of 110 cases diagnosed as "fevers of the typhus group" that occurred among British and Indian troops in India during 1934. In discussing the epidemiology, the author points out that the occurrence of differing serological types suggests the existence of more than one vector. In the present series, there was an absence of any history or evidence of tick-bite, except in one case where a papule with a necrotic centre was observed, and no ticks were seen. The close resemblance between one group of cases and Malayan scrub typhus suggests that a mite may be the vector, and in the group of cases that most nearly resemble endemic typhus the vector may be a flea.

SERGENT (A.) & LÉVY (H.). **Spirochétose hispano-africaine chez un homme piqué par une tique du chien** (*Rhipicephalus sanguineus*). —*Bull. Soc. Path. exot.* **28** no. 9 pp. 789–790, 4 refs. Paris, 1935.

A case of relapsing fever due to *Spirochaeta hispanica* is recorded from Algiers in a man bitten by a male of *Rhipicephalus sanguineus*, Latr., while removing ticks from a dog in a locality where ticks of the genus *Ornithodorus* have not been found. The tick was attached to his forearm and, in addition, his fingers had been contaminated with the intestinal contents of some of the ticks. This observation confirms the natural infection of *R. sanguineus* by *S. hispanica* already recorded [*R.A.E.*, B **21** 245].

TOUMANOFF (C.) & HU (S. M. K.). **Sur le comportement trophique d'***Anopheles hyrcanus* **var.** *sinensis* **dans la région de Shanghaï.**—*Bull. Soc. Path. exot.* **28** no. 9 pp. 832–835, 2 refs. Paris, 1935.

Although the incidence of malaria in the Kaochiao district of Shanghai is low, owing, it is believed, to animal deviation of the vector, *Anopheles hyrcanus* var. *sinensis*, Wied. [*cf. R.A.E.*, B **23** 34], the disease persists. As the peak of malaria incidence appears to be correlated with the period of maximum density of the mosquito [*cf.* **23** 219], precipitin tests were undertaken to determine whether the Anophelines found in the man-baited trap [*loc. cit.*] and in human habitations were really engorged with human blood or whether a part of them had sought shelter only in these situations [*cf.* **23** 81], and whether they are entophilous, preferring to bite in enclosed spaces, exophilous, preferring to bite in the open air, or amphophilous, having no marked preference in this respect [see next paper].

Of the 721 females taken in cattle sheds, 99 per cent. contained cattle blood; of 443 caught in sheds with both cattle and pigs, 47·4 contained cattle blood, 50 per cent. pig blood and the remainder human blood; and of 172 taken in houses and 193 in a man-baited trap, 95 and 100 per cent. respectively contained human blood. Thus *A. hyrcanus* var. *sinensis* in this region is markedly entophilous; it

attacks its hosts in shelters and remains in the immediate neighbourhood. The persistence of malaria may be explained by the fact that at times of their maximum density some of the Anophelines enter human habitations and, owing to their entophilous habits, remain in contact with man. Although zoophilism in this region plays an important part in protecting the population, it does not bring about a complete deviation of the Anophelines, for the animal sheds are arranged in a haphazard manner in relation to human habitations, and the breeding places of the mosquitos are numerous and scattered. A better arrangement of the animal sheds and the maintenance of a larger number of animals would probably produce beneficial results.

Roubaud (E.) & Toumanoff (C.). **L'indice maxillaire et l'orientation trophique chez les anophélines d'Extrême-Orient.**—*Bull. Soc. Path. exot.* **28** no. 9 pp. 835–838, 4 refs. Paris, 1935.

Although some species of Anophelines with a high maxillary index are zoophilous and play little or no part in the transmission of malaria, while other species with a lower index are vectors [*R.A.E.*, B **21** 140], further investigations have shown that still other species, though paucidentate, are zoophilous [*cf.* **23** 81], do not attack man for preference, and apparently play no part in the transmission of malaria in Cochin China and Tonkin. The reason why the maxillary index of such species has not increased in proportion to the degree of zoophilism exhibited is discussed. The process of selection only operates under stress of competition when many mosquitos attempt to feed on a relatively small number of animals in an enclosed space. In the case of such species as *Anopheles maculipennis*, Mg., it is connected with the character of entophily or preference for feeding in an enclosed space. In the case of the multidentate species in the Far East, such as *A. hyrcanus*, Pall., entophily is also manifested, although to a less degree, and has led in the same way to an increase in the maxillary index. These factors do not operate on species that are exophilous, *i.e.*, that feed on animals in the open. In these wild species, an abundance of nourishment is provided by a large number of wild animals or by domestic animals living out of doors, and competition does not come into play to the same degree. Investigations have shown that in Indo-China the paucidentate zoophilous species are essentially those that are wild and attack animals in the open or in very inadequate shelters. On the other hand, *A. minimus*, Theo., which is entophilous, is at the same time markedly anthropophilous, but man being more numerous and more easily accessible than animals, it has remained paucidentate, as have the other species that habitually attack man indoors.

Monier (H.). **Notes sur le paludisme à Madagascar.**—*Bull. Soc. Path. exot.* **28** no. 9 pp. 878–880. Paris, 1935.

To the species of *Anopheles* already recorded from Madagascar [*R.A.E.*, B **23** 271; **24** 13], the author adds *A. maculipalpis*, Giles, of which a few examples were taken in the region of Lake Alaotra. *Plasmodium malariae* has been found to be present in Madagascar, but is evidently rare and only occurs at the end of the winter (July–September).

Hu (S. M. K.). **Studies on the Susceptibility of Shanghai Mosquitoes to Experimental Infection with** *Wuchereria bancrofti* **Cobbold. IV.** *Aëdes vexans* **var.** *nipponii* **Theobald.**—*Peking nat. Hist. Bull.* **10** pt. 2 pp. 127–131, 9 refs. Peiping, December 1935.

In 1933–34, experiments similar to those already noticed [*cf. R.A.E.*, B **23** 213, 285] were carried out in Shanghai to test the susceptibility of reared adults of *Aëdes vexans* var. *nipponii*, Theo., to infection with *Filaria* (*Wuchereria*) *bancrofti*. Of the 195 examples fed on a heavily infected person, 140 harboured parasites when they were dissected 10 or more days after the infecting feed. All the parasites were of the microfilarial form and were dead (even in mosquitos that had been alive at the time of dissection), having undergone chitinous encapsulation. As reported by Yamada [**17** 10], they evidently die soon after having penetrated through the stomach wall of the mosquito without undergoing much further development. In 110 mosquitos they were found in the abdominal cavity, in 17 in the thorax and in 13 in both. From these findings it is concluded that *A. vexans* var. *nipponii* is unlikely to be a vector of filariasis in the Shanghai region.

Chamberlin (R. V.) & Rees (D. M.). **Survey of Mosquitoes and Mosquito Abatement Work of Salt Lake City 1934.**—4to, 100 pp. multigraph. Salt Lake City, 1935.

A detailed account is given of the seasonal prevalence of mosquitos in Salt Lake City in 1934, and of the various anti-larval measures, including drainage, oiling and the distribution of *Gambusia affinis*, that were carried out during the year. The principal mosquitos have already been noticed [*R.A.E.*, B **23** 237].

Ram (Raja). **Anti-malarial Engineering. Control of Anopheline Larvae in running Water by means of Mechanical Devices for Flushing and Flooding.**—*Indian Engng* **98** no. 4 pp. 122–127, 11 figs. Calcutta, October 1935.

Descriptions are given, with detailed illustrations, of devices that may be used in different situations in which it is necessary to carry out periodic flushing for the destruction of Anopheline larvae as an anti-malarial measure. These include different types of automatic discharge siphons, an automatic tipping trough, and various drop gates, shutters and sluices.

Pandazis (G.). **La faune des Culicides de Grèce.**—*Acta Inst. Mus. zool. Univ. Athen.* **1** fasc. 1–2 pp. 1–27, 46 refs. Athens, 1935.

A list is given of the mosquitos occurring in Greece, with notes where possible on their distribution, habits, seasonal prevalence and relation to disease. The Anophelines are *Anopheles algeriensis*, Theo., *A. claviger*, Mg. (*bifurcatus*, auct.), *A. hyrcanus*, Pall. (the typical form, var. *pictus*, Lw., and var. *pseudopictus*, Grassi), *A. maculipennis*, Mg. (the typical form and var. *messeae*, Flni.), *A. marteri*, Sen. & Prun., *A. plumbeus*, Steph., *A. sacharovi*, Favr, *A. italicus*, Raff., and *A. superpictus*, Grassi. *A. gambiae*, Giles, has not been found since it was first recorded [*R.A.E.*, B **18** 161], and the author believes that the record was probably due to an error in labelling. He considers

that *A. cardamatisi*, Newst. & Cart., *A. macedoniensis*, Cot & Hov., *A. palestinensis*, Theo., and *A. atheniensis*, Cardamatis, recorded by Cardamatis [*cf.* **19** 133], are all synonyms of *A. superpictus* and that the same author's record of *A. vagus*, Dön., is probably incorrect as this species has not been taken in the Palaearctic region. Among the other species, *Aëdes aegypti*, L., which is the vector of dengue [**19** 132], is the only one of pathological importance.

[GUTZEVICH (A. V.).] **Гуцевич (А. В.). Ueber die Stechmücken der Chibiner Berge.** [On the Mosquitos of the Khibin Mountains.] [*In Russian.*]—*Mag. Parasit.* **4** pp. 5–17, 3 figs., 16 refs. Leningrad, 1934. (With a Summary in German.) [Recd. January 1936.]

The results are given of a study of mosquitos collected by V. Yu. Fridolin in 1930–31 and 1932 in apatite workings and their vicinity in the Khibin mountains of the Kola peninsula. The collection comprised 4 species of *Aëdes* and 2 of *Theobaldia* including some 1,500 specimens, about half of which were taken as adults and half reared from larvae. A list is given of the 14 species of mosquitos previously recorded from within the Arctic circle in the Russian Union, including *Anopheles maculipennis*, Mg. In the collection from the Khibin mountains, practically all the mosquitos belonged to the genus *Aëdes*, of which *A. pullatus*, Coq., and *A. punctor*, Kby. (*meigenanus*, Dyar), were predominant, and *A. communis*, DeG., was next in abundance. All these species had only one generation a year and bred in small accumulations of water among lumps of turf in peat bogs, *A. pullatus* preferring warm pools that were well exposed to the sun.

[PETRISHCHEVA (P. A.).] **Петрищева (П. А.). Zur Biologie von *Anopheles bifurcatus* in Turkmenien.** [Contribution to the Biology of *A. claviger* in Turkmenia.] [*In Russian.*]—*Mag. Parasit.* **4** pp. 19–30, 8 figs., 2 graphs, 6 refs. Leningrad, 1934. (With a Summary in German.) [Recd. January 1936.]

A survey carried out in Turkmenistan in 1932 showed that *Anopheles claviger*, Mg. (*bifurcatus*, auct.) is widely distributed in all the foothill and mountain regions, the larvae occurring throughout the year in shady mountain gorges and from October to about mid-May in the open plains. They thrived in a variety of breeding places [*cf. R.A.E.*, B **23** 73], including shallow ditches overgrown with or devoid of vegetation, flooded areas along the banks of large irrigation ditches covered with dense low vegetation, places in mountain streams with a slow current, wells and pits in which the water was not more than 6–10 feet below the surface of the ground, and springs, even those having a definite smell of hydrogen sulphide. They sometimes occurred together with larvae of *A. superpictus*, Grassi, *A. hyrcanus*, Pall., and *A. maculipennis*, Mg.

The adults were rare in and near dwellings, but comparatively abundant in burrows of animals, caves, etc., and among dense growths of reeds and other vegetation, usually occurring near the breeding places together with *A. hyrcanus* and *A. superpictus*. They were most numerous in February–March and November–December, the mean temperatures being 6·7°C. [44°F.] and 6·3°C. [43·3°F.], respectively. They were scarce from April to the end of October, when

the average temperature was 16·5°C. [61·7°F.] and in January when it was 1·1°C. [34°F.]. The pupae were also most abundant in spring and autumn, when the mean temperature of the water was 14°C. [57·2°F.] and 15·5°C. [59·9°F.] respectively. The number of generations a year may vary from 2 to 4, but was not definitely ascertained.

This mosquito cannot be of much importance as a vector of malaria in Turkmenistan as it does not fly far, is rare in and near dwellings, and is most numerous under conditions that are unsuitable for the development of the malaria parasite in it.

MARTINI (E.). **Der Sowjetunion Bedeutung für das Problem der** *Anopheles maculipennis* **Rassen.** [The Importance in the Soviet Union of the Problem of Races of *A. maculipennis*.] [*In German.*] —*Mag. Parasit.* **4** pp. 31–42, 3 figs., 10 refs. Leningrad, 1934. (With a Summary in Russian.) [Recd. January 1936.]

The author discusses various problems relating to the races of *Anopheles maculipennis*, Mg., including differences in their bionomics and importance in the transmission of malaria, and their geographical distribution and factors governing it, and draws attention to the desirability of studies on these problems in the Russian Union, in view of the varied conditions of climate, topography and incidence of malaria represented there. Descriptions of the characters of the eggs of typical *maculipennis*, var. *atroparvus*, van Thiel, and var. *messeae*, Flni., and of the larvae and adults of the two last named races are included.

[BEKLEMISHEV (V.), SHIPITZINA (N.), POLOVODOVA (V.) & NABOKIKH (P.).] **Беклемишев (В.), Шипицина (Н.), Половодова (В.) и Набоких (П.). Ueber die Genauigkeit der Abundanzbestimmung von** *Anopheles maculipennis* **Larven in pflanzenbewachsenen Gewässern.** [On the Exactness of the Determination of the Abundance of the Larvae of *A. maculipennis* in Waters covered with Vegetation.] [*In Russian.*]—*Mag. Parasit.* **4** pp. 43–63, 1 graph, 5 refs. Leningrad, 1934. (With a Summary in German.) [Recd. January 1936.]

A detailed account is given of investigations in 1930 and 1931 on the reliability of a method employed to determine the abundance of the larvae of *Anopheles maculipennis*, Mg., in various breeding places covered with vegetation in the valley of the river Ural near Magnitogorsk [*cf. R.A.E.*, B **20** 90]. The larvae were taken in small ponds, etc., in a flooded area with a net made of fine bolting cloth, each sweep covering a definite area of water surface.

The points studied were the percentage of larvae captured and the degree of exactness of the method. The percentage of the larvae taken was determined by repeated sweepings of the same breeding place, with a subsequent extrapolation of the results obtained. The numbers of the larvae and pupae caught in the different plant communities by individual sweeps, and by series of sweeps, are shown in tables. The total number of larvae and pupae taken in the same breeding place by a series of sweeps decreased with each subsequent series, 50·1–58·9 per cent. being taken in the first series irrespective

of the total abundance of the larvae and pupae. The number taken in each of the following series of sweeps averaged 38·1 per cent. of that in the preceding series. In communities of Elodeids reaching the surface of the water the results obtained were fairly constant.

The exactness of the method was determined by calculating the absolute and relative mean errors in the estimation of the larval density. The magnitude of the mean error decreases as more sweeps are made, but also depends on the evenness of distribution of the larvae, which differs in various types of plant communities. Their distribution is uneven when the plant growth on the surface of the water is thick enough to prevent them moving about. On an average, the larvae are abundant where submerged vegetation predominates, and are scarce if there is a prevalence of plants floating on the surface of the water or rising above it [*cf.* **22** 75]. The mean density of larvae and the average mean error for 12 different types of plant communities are given in a table, which shows that the absolute mean error increases as the larval population becomes more dense, whereas the relative mean error decreases.

When comparing the abundance of larvae in different breeding places, it is necessary to make a greater number of sweeps in plant communities with a sparse larval population in order to minimise the relative mean error. On the other hand, when determining the Anopheline production in a given district, abundance should be expressed in absolute figures, and more sweeps should, therefore, be made in water with a dense larval population.

[MONCHADSKIĬ (A.).] **Мончадский (А.). Ueber das Wachstum und die Funktion der Analkiemen bei den Larven von** *Anopheles maculipennis* **Mg.** [On the Growth and Function of the Anal Gills of the Larvae of *A. maculipennis*.] [*In Russian.*]—*Mag. Parasit.* **4** pp. 65–83, 5 graphs, 14 refs. Leningrad, 1934. (With a Summary in German.) [Recd. January 1936.]

On the basis of his observations on the development of larvae of *Anopheles maculipennis*, Mg. [*R.A.E.*, B **20** 154], the author questions the assumption of Beklemishev and Mitrofanova [**14** 131] that the anal gills serve for the absorption of the oxygen dissolved in water and that the larvae of the fourth instar are less capable of cutaneo-branchial breathing than the younger ones owing to certain changes that take place in the anal gills. The relations existing between the length of the body of the larva and that of the gills are shown in tables, and it is pointed out that they differ from those that may be obtained as result of a summary analysis of casual material. The gradual changes that take place in the length of the body and of the gills during growth are discussed in detail, and it is emphasised that the growth of the gills is subject to much more complicated laws than the growth of the body. The causes of the changes in the length of the gills can hardly be ascribed to the effect of environmental factors, but are probably due to some internal, physiological processes. On the basis of data from the literature and observations on the respiration of various mosquito larvae, the author believes that the function of the anal gills is not so much respiratory as eliminatory in the broad sense of the word. The fact that the length of the gills varies with the salinity of the water [**10** 128] seems to indicate that the gills also serve to regulate osmosis [*cf.* **21** 74].

[GORITZKAYA (V.).] **Горицкая (В.). Einige Beobachtungen an** *Pl. praecox* (*Proteosoma*) **in den Versuchen der experimentellen Infektion von** *Culex pipiens*. [Some Observations on *P. praecox* in Experiments with artificial Infection of *C. pipiens*.] [*In Russian*.]—*Mag. Parasit.* **4** pp. 85–92. Leningrad, 1934. (With a Summary in German). [Recd. January 1936.]

An account is given of laboratory studies carried out in central Ukraine on the development of *Plasmodium* (*Proteosoma*) *praecox* in *Culex pipiens*, L. Hibernating females, taken chiefly in cellars, were induced to feed on sparrows harbouring gametocytes. The mosquitos readily sucked blood only at the end of winter, after they had used up the reserve of fat body. They were easily infected, oöcysts or sporozoites developing in 83–92 per cent. Complete development of the parasite occurred in mosquitos kept at a temperature as low as 14–12°C. [57·2–53·6°F.]. It survived in mosquitos up to 2 months. In the initial stages of its extrinsic cycle it was destroyed by high or low temperatures that it was able to resist after developing for a few days at a favourable temperature.

[BURAKOVA (L. V.).] **Буракова (Л. В.). Zur Methodik der Untersuchung und des Nachweises der** *Phlebotomus*-**Arten.** [Contribution to the Method of observing and collecting *Phlebotomus*.] [*In Russian*.]—*Mag. Parasit.* **4** pp. 93–98, 2 refs. Leningrad, 1934. (With a Summary in German.) [Recd. January 1936.]

Notes are given on methods used to collect sandflies (*Phlebotomus*) in various parts of the Russian Union. Good results were obtained with sheets of paper smeared with a thin layer of castor oil [*cf. R.A.E.*, B **23** 165], or preferably a mixture made of equal parts of castor oil, rifle oil and resin, and with traps consisting of a cone and cylinder of wire gauze forming the entrance to a muslin sleeve and fixed over openings in doors, windows, etc. [*cf.* **23** 3]. Systematic collections serve to determine the distribution, the succession and prevalence of species, the time necessary for the development of a generation, and sometimes the proximity of a breeding place.

[OLSUF'EV (N. G.).] **Олсуфьев (Н. Г.). Beiträge zur Tabanidenfauna des Leningrader Gebiets.** [Contribution to the Fauna of Tabanids in the Leningrad Region.] [*In Russian*.]—*Mag. Parasit.* **4** pp. 111–201, 17 figs., 2 graphs, 18 refs. Leningrad, 1934. (With a Summary in German.) [Recd. January 1936.]

This survey of the Tabanids of the Leningrad region (including the former Departments of Leningrad, Pskov, Novgorod and Olonetz and the Kola Peninsula) is based on examination of collections and data from the literature. The first part includes a list of the 35 species dealt with, of which 6 species of *Tabanus* and 1 of *Haematopota* (*Chrysozona*) have not previously been recorded from the region, and a discussion of the distribution of various species in the different types of country, with tables showing the phenology and abundance of some 17 species observed by the author in the forest zone. The second part contains keys to the genera of the family and the species of the Leningrad region, followed by detailed descriptions of the species, including the males of *T. arpadi*, Szil., and *T. confinis*, Zett., and the female of

T. aethereus, Big., which have not been described previously. In each case brief notes on the localities, frequency and periods of occurrence of the species are included.

[TINKER (I. S.) & ZENKEVICH (A. M.).] **Тинкер (И. С.) и Зенкевич (А. М.). Einige Beobachtungen in Bezug auf die Oekologie der Zieselmausflöhe im Zusammenhang mit ihrer Rolle in der Epidemiologie der Pest.** [A few Observations on the Ecology of the Fleas of the Ground Squirrel in Connection with their Rôle in the Epidemiology of Plague.] [*In Russian.*]—*Mag. Parasit.* **4** pp. 203–215, 3 figs. Leningrad, 1934. (With a Summary in German.) [Recd. January 1936.]

An account is given of experiments in the northern Caucasus in the summer of 1930 and the spring of 1931 on the question of migration of the fleas of ground squirrels [*Citellus*] to and from the burrows of their hosts, and their fate after they have abandoned the host. To trace the migration of the fleas two wads of cotton-wool were placed about an inch apart in the burrows, the wad nearest to the entrance hole being about 2 ins. from the surface of the soil. The wads inserted in the morning were examined 1, 2, 3, 9 and 12 hours after their introduction, and all the fleas found were on the outer end of the outer wad, showing that during the day they pass from the field into the burrows. On the other hand, when the wads were inserted in the evening and removed in the morning, the fleas were on the inner end of the inner wad, thus showing a tendency to migrate at night from the burrows to the steppe. The fleas concerned were *Ceratophyllus tesquorum*, Wagn., and in smaller numbers *Neopsylla setosa*, Wagn. In casual collections made on six occasions in April and May 1930 and in April 1931, 190 fleas of these two species were taken on the surface of the soil. These findings seem to contradict those of I. I. Traut, who considered that the fleas never abandon the burrows unless carried by their hosts and only rarely enter them [*R.A.E.*, B **17** 158]. When fleas of these two species were exposed to the sun in glass jars, most of them survived 3 hours' exposure in spring when the temperature was not more than 30°C. [86°F.] and the humidity was rather high. In June, however, when it was drier and the temperature was 35°C. [95°F.], the fleas were killed in 15–38 minutes.

[ZOLOTAREV (N. A.).] **Золотарев (Н. А.). Zum Artenbestand und zur geographischen Verbreitung der Zecken (Ixodidae) in Dagestan.** [Contribution to the Knowledge of the Species and geographical Distribution of the Ticks in Daghestan.] [*In Russian.*]—*Mag. Parasit.* **4** pp. 217–227, 2 graphs. Leningrad, 1934. [Recd. January 1936.]

In view of plans for the extensive breeding of sheep and cattle in Daghestan and the high percentage of mortality caused by piroplasmosis and similar diseases among domestic animals there, investigations were carried out in 1931–32 on the occurrence of ticks, collections being made in 13 districts out of the 26 into which the republic is divided. Altogether, 14 species of ticks were found, of which *Ixodes ricinus*, L., *Haemaphysalis cinnabarina punctata*, C. & F., *H. sulcata*, C. & F., *Dermacentor silvarum*, Olen., *D. marginatus*, Sulz.

[*cf. R.A.E.*, B **23** 139], *Rhipicephalus sanguineus*, Latr., *R. bursa*, C. & F., *Hyalomma marginatum*, Koch, and *H. volgense*, Sch. & Schl., occurred on cattle, horses and sheep. Of these, *H. sulcata* also occurred on camels, goats and dogs; *H. cinnabarina punctata* on goats; *R. sanguineus* on camels, dogs and cats; *H. volgense* on camels; and *I. ricinus* and *D. marginatus* on dogs. Other species were: *H. inermis*, Bir., on cattle, sheep and dogs; *D. niveus*, Neum., on cattle, horses and camels; *Boophilus annulatus calcaratus*, Bir., on cattle, horses, goats and camels; *H. savignyi*, Gerv., on cattle and camels; and *H. cholodkovskii*, Olen., on sheep.

The distribution of the ticks in the three natural zones of Daghestan, the plain, the foot hills and the mountains, is discussed in detail. Arsenical dips proved of great value in reducing infestation.

[LINDBERG (G. U.).] **Линдберг (Г. У.). Zur Kenntnis der Gattung** *Gambusia*. [Contribution to the Knowledge of the Genus *Gambusia*.] [*In Russian*.]—*Mag. Parasit.* **4** pp. 351–367, 5 figs. Leningrad, 1934. [Recd. January 1936.]

In view of recent work on the acclimatisation of *Gambusia* against mosquito larvae in the Russian Union [*cf. R.A.E.*, B **22** 193; **24** 11], detailed descriptions are given of the morphology of the male gonopodium and of both sexes of *G. affinis* and *G. holbrooki*, which is considered a subspecies of it. Brief notes on their distribution in the world are included, and the characters differentiating them are discussed and shown in a table and a key. Since both have been acclimatised in the Russian Union, the object of the paper is to assist the identification of the fish that may be introduced in various localities.

KEMP (H. A.), MOURSUND (W. H.) & WRIGHT (H. E.). **Relapsing Fever in Texas. V. A Survey of the Epidemiology and Clinical Manifestations of the Disease as it occurs in Texas.**—*Amer. J. trop. Med.* **15** no. 5 pp. 495–506, 3 figs., 4 refs. Baltimore, Md, September 1935.

The information contained in this paper on the distribution and symptoms of relapsing fever in Texas during 1930–34 is based on the replies to questionnaires sent to different parts of the State. Practically all the cases reported were among persons on farms and ranches, and in the few cases that occurred in cities there were possibilities that the infections had originated in visits to rural areas. The seasonal incidence, late summer and autumn, coincides with the seasonal activity of *Ornithodorus turicata*, Dugès [*cf. R.A.E.*, B **22** 245]. The incidence of the disease appears to be restricted to certain tick-infested localities within a given district.

ROZEBOOM (L. E.). **Infection of** *Anopheles bachmanni*, **Petrocchi, with** *Plasmodium vivax*, **Grassi and Feletti, and Observations on the Bionomics of the Mosquito.**—*Amer. J. trop. Med.* **15** no. 5 pp. 521–528, 4 refs. Baltimore, Md, September 1935.

Experiments are described in which two batches of *Anopheles bachmanni*, Petrocchi, were fed on persons infected with *Plasmodium vivax*, and a third batch that was almost certainly the same species, was fed on a person infected with *P. falciparum*. In the first, 3 out

of 7 became infected, all with oöcysts; in the second 3 out of 11, 2 with oöcysts and 1 with sporozoites; and in the third, 2 out of 13, both with oöcysts. Of the examples of *A. albimanus*, Wied., fed at the same time to act as controls, the numbers that became infected were 5 out of 5, 1 out of 1, and 7 out of 14 respectively. The single example of *A. bachmanni* that contained sporozoites was dissected 9 days after the infective blood meal. A comparison of the number of oöcysts found in the stomachs suggests that not only was a larger percentage of *A. bachmanni* refractory to infection, but also that even the susceptible individuals were less susceptible than *A. albimanus*.

In Panama larvae of *A. bachmanni* are usually found in patches of *Pistia stratiotes* [*cf. R.A.E.*, B **20** 93]. Observations on breeding in a limited area for more than four months indicated that a certain patch of this plant was more attractive to ovipositing females than other patches, and also certain areas within this patch. The only noticeable differences between this patch and the others were that it was nearer the shore and was shaded in the morning by trees that overhung the water, it was the first to be met by a female returning from the jungle to oviposit, and the temperature of the water was about 1½ degrees lower. Females were observed to attack man in the jungle in the daytime.

Johannsen (O. A.). **Aquatic Diptera. Part II. Orthorrhapha-Brachycera and Cyclorrhapha.**—*Mem. Cornell agric. Exp. Sta.* no. 177, 62 pp., 12 pls., 4 pp. refs. Ithaca, N.Y., 1935.

Keys are given to the larvae and pupae of the North American families, genera and sometimes species, with notes on the characters and habitats of some of the genera and species [*cf. R.A.E.*, B **23** 71].

Mote (D. C.) & Gray (K.). **The Black Widow Spider** (*Latrodectus mactans* **Fabr.**).—*Circ. Ore. agric. Exp. Sta.* no. 112, 9 pp., 5 figs., 9 refs. Corvallis, Ore., June 1935. [Recd. December 1935.]

During 1934, *Latrodectus mactans*, F., became unusually abundant in Oregon, and this brief account of its morphology, distribution and bionomics, and of the symptoms produced by its bites, and methods of treating or preventing them has been compiled in response to requests for information [*cf. R.A.E.*, B **23** 212, etc.].

Stewart (J. L.). [Report of the] **Veterinary Laboratory.**—*Rep. Dep. Anim. Hlth Gold Cst 1934–35* pp. 12–22. Accra, 1935.

The range of flight of tsetse flies of the group of *Glossina palpalis*, R.-D., has been consistently found (except in the total absence of low shade) to be considerable, and several hundreds of yards of open ground without shade may be crossed by the fly. Thus, extensive clearings are apparently necessary to free an area permanently from fly, though small ones round water holes and at river crossings are useful in protecting man and animals during the dry season (December–May), when the fly remains close to its breeding grounds under the low shade of river banks at places where there is water in the river.

In spite of the additional clearing carried out in the previous year (1933–34) on the Naboggo River [*cf. R.A.E.*, B **22** 237], flies penetrated the cleared section from the uncleared areas both upstream and down during August–October, when the river was at its highest. They began to breed in a banana plantation three miles from the uncleared part

of the river, and several pigs in the neighbourhood became infected with trypanosomiasis. During the year, vegetation was cleared along the river banks for a further mile upstream, from the edges of lagoons in the vicinity, and for a further 2,300 yds. downstream. In the last 100 yds. the trees and shrubs were felled but not cut up, and the area will be left unburned, as it is proposed to grow a thick impenetrable barrier of vegetation 50–75 yds. wide. The seeds of suitable shrubs and low-growing trees are being collected. In the course of maintaining existing clearings, it was found that certain trees and shrubs were not killed by felling, burning and flooding, and grew up again within the next year or two ; it is recommended that in future the stumps of these species should be uprooted. A total of 23 miles of river has now been cleared, together with all places likely to become secondary foci. At the western (downstream) end of the clearing 1,000 flies were caught, marked by removing one of their tarsi, and liberated in the early rains in June 1934 over a period of 6 days. One *G. palpalis* and 21 *G. tachinoides*, Westw., were recaptured during August and September when the river was in flood at places one to six miles distant, some in the open, some under low shade and some in a village two miles from the river, but none under high shade trees. Although a few flies were caught in the clearing near to the uncleared area downstream when the river started to rise, none was caught or seen during the height of the dry season, when it was necessary to send cattle to the river for grazing, and no cases of trypanosomiasis occurred. Screens were used for a month for capturing flies, and black ones proved more attractive than brown or khaki. Trapping as a means of control has proved unsatisfactory and has been abandoned. Of 323 flies of the two species dissected, 36 (11·1 per cent.) were infected, 24 with *Trypanosoma vivax*, 2 with *T. congolense*, 1 with a trypanosome resembling *T. vivax* and 9 with unidentified trypanosomes. The proportion of *G. palpalis* to *G. tachinoides* decreased from 1 : 61 in the previous year to 1 : 293 during the present year. This may be connected with the fact that game has decreased during the last two years and man and cattle visit the river almost entirely at spots within the cleared area. Collections of puparia made over periods of 7 days yielded 153 in January, 147 in February and 24 in March.

During the dry season short surveys were made in the Yendi and Gambaga Districts and the predominant fly was found to be *G. palpalis*, which appears to be widespread in the Northern Territories. Of 97 examples of this fly caught near Gambaga, 72 were in cleared areas that extended along streams for 300 yards on each side of the road, a finding that confirms the uselessness of small clearings against flies of this group.

Lester (H. M. O.). **Report of the Tsetse Investigation.**—*Rep. med. Hlth Serv. Nigeria 1934* pp. 69–88. Lagos, 1935.

The trypanosome infection rate in *Glossina morsitans submorsitans*, Newst., is usually so high in Nigeria (30 to 60 per cent. being common) that the local cattle cannot withstand constant attack by this species of tsetse. If an animal has recovered from an attack of trypanosomiasis either naturally or through treatment, it may have acquired an increased resistance to the strain with which it was previously infected, but there is little likelihood of its being resistant to massive infection with different strains. An animal bitten by large numbers

of this fly is likely to become infected with several mixed strains of *Trypanosoma vivax* and *T. congolense*. The resultant infection is usually virulent and most of the animals die. In an experiment in which animals that had recovered from infection were exposed to the bites of wild flies in the field, all lost condition and weight, and 6 out of 9 died, although trypanosomes were at all times scarce in their blood. Evidently their state of premunition was sufficient to modify the infection but not to prevent mortality.

For some time a trypanosome isolated from man has been maintained in guineapigs by constant cyclical transmission through *G. tachinoides*, Westw., and *G. morsitans submorsitans*. It has been noticeably easier to pass it through the former than through the latter. A comparison of this strain after it had undergone 25 consecutive cyclical passages through *G. tachinoides* with the same strain after 7 consecutive passages through *G. morsitans submorsitans* revealed no significant differences, so that there is no proof that the species of fly plays any part in determining the characteristics of a trypanosome. In the field the rate of infection appears to be higher in *G. tachinoides* than in *G. palpalis*, R.-D., and in the laboratory it seems easier to transmit strains of trypanosomes isolated from man through the former than through the latter. These findings may explain the divergent views in East and West Africa regarding the question of non-transmissible strains. Apparently cyclical transmission is easier in one species than another ; a strain that has a low transmissibility in *G. tachinoides* may be non-transmissible by *G. palpalis*, and similarly East African strains that are non-transmissible by *G. palpalis* may be transmissible by other species.

The report of Dr. T. A. M. Nash on the entomological work carried out at Gadau, Northern Nigeria is given. The experiments dealing with the effect of temperature on the longevity of the fly have already been noticed [**23** 142]. For nearly two years, data on the tsetse fly population have been taken on a track 3½ miles long that passes through different types of bush. It has been found that at the beginning of the rains the numbers of *G. tachinoides* and *G. morsitans submorsitans* begin to increase, they reach their maximum by the end of the wet season, begin to decrease soon after the dry season begins, reach their lowest point from December to April, and do not start to increase again until the rains break. Similar seasonal fluctuations have been observed in East Africa, and it seems probable that in all parts of Africa the numbers of fly rise and fall rhythmically with the seasons. Clearings should be made at the beginning of the dry season, for not only will the damage to the vegetation be more lasting but it is the time that is naturally unfavourable to the fly. The percentage of *G. tachinoides* containing blood is higher than that of *G. morsitans submorsitans*, probably because the former has a less specialised diet, feeding on both mammals and reptiles, whereas the latter is mainly dependent on game. Both species are most hungry in the rainy season when the grass is long and food is hard to find, and again during the harmattan season when the cold overcast mornings limit their period of activity. They are best fed at the end of the dry season when game is concentrated near their haunts, but at this time their numbers are lowest, a fact indicating that climate is of more importance in their control than lack of food. Although on emerging from puparia the sexes are about equal, among large numbers caught attacking man during 22 months only 14 per cent. of *G. morsitans*

submorsitans were females as compared with 32 per cent. of *G. tachinoides*. The view that this is due to the dislike of the former for human blood, which it only imbibes when forced by hunger, is supported by the fact that the female percentage in this fly is only high at times when it shows definite signs of hunger. These findings indicate that *G. tachinoides* is probably a more important vector of sleeping sickness; fortunately it is more easily controlled by bush clearing. The apparent cessation of breeding for four months during the rains was found to be due to the mechanical difficulty of finding puparia in damp humus, since 51 puparia of *G. tachinoides* were taken in June and July and 40 in September in a patch of riverine forest in which a shelter had been erected to keep the ground dry. None, however, was taken in August, the wettest month of the year. Further collections showed that this fly breeds freely in October, but that reproduction is arrested in December and January when the cold harmattan weather is at its height.

The legal position regarding the exaction of unpaid labour for making protective clearings and the moving and concentration of populations is discussed.

CARPENTER (G. D. H.). **Observations by Mr. T. W. Chorley, F.R.E.S., on Dragonflies attacking the Tsetse Fly,** *Glossina palpalis* **R.-D.**—*Proc. R. ent. Soc. Lond.* **10** pt. 2 pp. 78–79. London, 30th December 1935.

In Uganda, dragonflies were observed to attack and kill tsetse flies (*Glossina palpalis*, R.-D.) while in flight in a clearing, the flies emitting a noise resembling several short squeaks. The flies were abundant in the forest a few yards from the edge of the clearing, where no dragonflies were to be seen. It would appear that the dragonflies help to prevent tsetse flies from crossing clearings.

ROBERTS (J. I.) & TONKING (H. D.). **Notes on an East African Vesicant Beetle,** *Paederus crebrepunctatus* **Epp.**—*Ann. trop. Med. Parasit.* **29** no. 4 pp. 415–420, 1 fig. Liverpool, 18th December 1935.

An account is given of observations and experiments on *Paederus crebrepunctatus*, Eppelsheim, a vesicating beetle that occurs commonly in and around Nairobi.

The following is substantially the authors' summary: The beetles occur in enormous numbers after periods of heavy rainfall, when there is a luxuriant growth of grasses, on the flowering heads of which they feed. The beetle is well known to Europeans as "Nairobi eye," owing to the conjunctivitis produced when the juices of crushed examples are rubbed into the eye. The toxic juices are excreted by the genital glands, and the fluid easily vesicates the unbroken skin. The vesicating principle is not destroyed by heat or desiccation. Compresses of magnesium sulphate give immediate relief.

EVANS (A. M.). **Notes on Anophelines. I.—Description of** *Anopheles marshalli* **var.** *gibbinsi* **from Uganda. II.—The Characters of** *A. maculipennis* **var.** *messeae* **in Wirral, England.**—*Ann. trop. Med. Parasit.* **29** no. 4 pp. 469–473, 1 fig., 12 refs. Liverpool, 18th December 1935.

From information on the typical form of *Anopheles marshalli*, Theo., as it occurs in the Transvaal and on *A. pitchfordi*, Giles (which is

regarded as a variety of it) in Natal, the author considers that the form associated with the transmission of malaria in Uganda [*cf. R.A.E.*, B **20** 279 ; **21** 131, 201] is a distinct variety, *A. marshalli* var. *gibbinsi*, n., and gives descriptions of all stages of it.

An examination of further material of *A. maculipennis* var. *messeae*, Flni., from Cheshire, including larvae and males reared from eggs, confirms the close resemblance of the forms of this variety occurring in England and Holland [*cf.* **22** 112]. With regard to hibernating habits [*cf. loc. cit.*], the females had evidently reached the end of their hibernating period by 14th February 1934, as they then took blood-meals in the laboratory at 64–68°F., and in the majority of cases oviposited in from 5½ to 11 days after one blood-meal (at 60–66°F.). At 76–78°F., oviposition followed in 3½–5 days after a single meal of blood (human or rabbit). Two females collected in October 1934 oviposited in December after taking two blood-meals. Swellengrebel suggests that the occurrence of normal digestion and precocious ovulation as early as December may indicate a biological difference between the forms of *messeae* in the two countries.

Patton (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. A Revision of the Species of the Genus *Glossina* Wiedemann based on a Comparative Study of the Male and Female Terminalia.**—*Ann. trop. Med. Parasit.* **29** no. 4 pp. 483–496, 11 figs., 5 refs. Liverpool, 18th December 1935.

In this paper, which is one of a series [*cf. R.A.E.*, B **23** 296], the terminalia of *Dermatobia hominis*, Say, *Cuterebra fontinella*, Clark, *C. approximata*, Wlk., *C. americana*, F., *C. atrox*, Clark, and two undetermined species of *Cuterebra* (*Bogeria*) are illustrated and their salient characters are described. The relation of the species and genera and the systematic position of the genera are discussed, and the author concludes that the genus *Bogeria* is not distinct from *Cuterebra*.

Séguy (E.). **Etude sur les stomoxydines et particulièrement des mouches charbonneuses du genre** *Stomoxys*.—*Encycl. ent.* B II Dipt. **8** pp. 15–58, 1 fig., 1 p. refs. Paris, 1935.

The characters distinguishing flies of the subfamily Stomoxydinae from other Muscids are given, and their taxonomy is discussed. The author considers the type of *Haematobia* to be *stimulans*, Mg. (*irritans*, F. *nec.* L.) [*cf. R.A.E.*, B **20** 165 ; **21** 24] and accepts only four genera : *Stomoxys*, *Haematostoma* [**20** 165], *Haematobia* (including *Haematobosca* and *Neivamyia* [**19** 90]) and *Lyperosia* (including *Bruceomyia* [**20** 165] and *Stygeromyia*). A key is given to the genera, with notes on such points as their scope, morphology, bionomics, association with disease and geographical distribution. The bionomics and control of *Stomoxys calcitrans*, L., are described in detail. Keys are also given to the males and females of the species of *Stomoxys* and to the females of the Palearctic species of *Haematobia*. Catalogues show the reference to the original description, the synonyms and the distribution of the species of the four genera, and three new species of *Stomoxys* and one of *Haematobia* are described.

Sugimoto (M.). **On the Ixodoidea of Formosa.** [*In Japanese.*]—*Kagaku no Taiwan* **3** no. 6 pp. 1–7, 2 figs. Taihoku, December 1935.

Brief notes are given on the 13 species of ticks now known to occur in Formosa, with descriptions of 2 new ones. They include : *Rhipicephalus sanguineus*, Latr., on dogs ; *Haemaphysalis flava*, Neum., *H. formosensis*, Neum., and *H. nishiyamae*, sp. n., on pigs and dogs; *Dermacentor taiwanensis*, sp. n., on pigs ; and *Ixodes ricinus*, L., on water buffalo, goats, etc. *R. sanguineus* and *H. nishiyamae* sometimes attack man.

Omori (N.). **On the Life History of *Liponyssus nagayoi* Yamada.** [*In Japanese.*]—*Tokyo Iji Shinshi* no. 2960 pp. 3250–3257, 1 fig. Tokyo, December 1935.

An investigation on the bionomics of *Liponyssus nagayoi*, Yamada [*cf. R.A.E.*, B **19** 156, etc.] was carried out at Taihoku, Formosa, the mites being fed on mice. The male adults usually lived 15–16 days (20 at most), fed two or three times and paired throughout life. The females paired more than once, lived 22–26 days and fed several times. They laid 115–128 eggs, depositing them singly at intervals of about 2 hours. The eggs hatched in 29·5–33 hours. Parthenogenesis produced males only. The larvae did not feed, scarcely moved, and moulted in 15–19 hours. The protonymphs begin to crawl 3 or 4 hours after moulting, and their activity gradually increased. They were positively thermotropic, especially 12–48 hours after moulting, and died in 4 or 5 days if unfed. They began to feed 12 hours after moulting, engorged in 12–18 hours and moulted about 12 hours later. In the deutonymphal stage, which lasted 14–15 hours, the mites did not feed. Descriptions of all stages are given.

Stage (H. H.). **Mosquito Control provides Work-relief Projects near Recreation Centers.**—*J. econ. Ent.* **28** no. 6 pp. 842–846, 1 fig. Geneva, N.Y., December 1935. **Mosquito-control Activities in the Pacific Northwest under the CWA Program.**—*T.c.* pp. 1022–1024.

In the first paper, the author points out the need for mosquito control in areas that are being increasingly used for outdoor recreation, and the suitability of drainage, filling, oiling and clearing of vegetation, as manual work for relief labour. Examples are given of the successful application of such measures under the Civil Works Administration in certain areas of Washington and Oregon.

In the second paper, an account is given of the mosquito control work carried out in Washington and Oregon from December 1933 to April 1934 under the Civil Works Administration. Three different types of mosquito breeding places were dealt with. The flood-water mosquitos, *Aëdes vexans*, Mg., and *A. lateralis*, Mg. (*aldrichi*, D. & K.), were reduced in numbers by clearing the heavy willow brush from their breeding places [*cf. R.A.E.*, B **22** 129–130]. *A. dorsalis*, Mg., was eradicated from an isolated salt marsh of 1,500 acres by connecting the holes in which it was breeding with the main channels by means of ditches, so that they were flushed and drained by the high tides. *A. aboriginis*, Dyar, and *A. fitchi*, Felt & Young, which breed in temporary pools, were controlled by clearing, draining and oiling.

HERMS (W. B.) & WHEELER (C. M.). **Tick Transmission of California Relapsing Fever.**—*J. econ. Ent.* **28** no. 6 pp. 846–855, 1 fig., 13 refs. Geneva, N.Y., December 1935.

The authors review the survey work that led to the discovery that *Ornithodorus hermsi*, Wheeler [*cf. R.A.E.*, B **23** 204] is the vector of relapsing fever in California [*cf.* **23** 221] and give an account of laboratory experiments with this tick [*cf. loc. cit.*], which showed that the spirochaete is transmitted by the bites of adults of both sexes and by the later nymphal stages. There is no evidence that either the coxal fluid or the faeces are infectious. Spirochaetes were found in the blood of chipmunks (*Eutamia*) and squirrels. One of the authors contracted the disease when his hand (on which there were lesions) was accidentally smeared with the blood of a squirrel shot a few moments previously. Attempts to transmit a strain of a spirochaete (originally obtained from chipmunks in a locality where cases of relapsing fever had occurred) from infected to healthy mice by the bites of *O. coriaceus*, Koch, or by the intraperitoneal inoculation of suspensions of these ticks gave negative results, except in one case in which one spirochaete was seen in a blood smear from a mouse.

FREEBORN (S. B.) & BERRY (L. J.). **Color Preferences of the House Fly,** *Musca domestica* **L.**—*J. econ. Ent.* **28** no. 6 pp. 913–916, 1 fig., 1 ref. Geneva, N.Y., December 1935.

In view of the increasing prevalence among dairymen in California of the idea that aluminium paint, when applied to the interior of dairy barns, is more repellent to *Musca domestica*, L., than white paint, experiments were undertaken to test the relative values of various colours in this respect. Exact details are given of the method of testing, which consisted roughly in painting six squares of each of twelve colours on a board, together with six white squares, fixing the board to the ceiling of a milking shed for three months from 20th June 1934, and at the end of that time counting the number of fly specks deposited on the various colours. It was apparent that the flies tended to congregate, regardless of colour, where the surface of the board had been roughened. A diagram shows the results of the statistical analysis of the figures obtained. The pale colours, including white, were distinctly more repellent than the intermediate ones, which included aluminium, and the darkest one was obviously the most attractive.

KNIPLING (E. F.) & WELLS (R. W.). **Factors stimulating Hatching of Eggs of** *Gasterophilus intestinalis* **De Geer and the Application of Warm Water as a Practical Method of destroying these Eggs on the Host.**—*J. econ. Ent.* **28** no. 6 pp. 1065–1072, 1 fig., 5 refs. Geneva, N.Y., December 1935.

In the course of studies on the biology of *Gastrophilus intestinalis*, DeG., in the United States, newly hatched larvae were obtained by placing eggs in warm water. The erratic results of this method led to an investigation of the factors that stimulate hatching. The eggs used were mostly collected at random from horses in the field. They were kept at room temperature for at least 7 days to ensure their complete development. As response to submergence occurs within a

few seconds or not at all, hatching counts were made after 1 minute. In the first series of tests, the eggs were kept in a refrigerator at 4·5–7°C. [40·1–44·6°F.] for 4–16 hours and then submerged in water at various temperatures ranging from 25 to 50°C. [77–122°F.], and a duplicate test was made with eggs known to be 14–18 days old. In the second series, the eggs were kept at room temperature, which ranged from 21 to 24°C. [69·8–75·2°F.] and submerged in water at temperatures ranging from 30 to 50°C. [86–122°F.]. In the third series, they were kept in an incubator at 33–34·5°C. [91·4–94·1°F.] for 4–6 hours and then submerged in water at temperatures ranging from 35 to 47·5°C. [95–117·5°F.]. In the first series, the highest average hatch, 95·5 per cent. (97·8 in the duplicate test), occurred at 42·5°C. [108·5°F.] ; the corresponding figures in the other two series were 60·71 per cent. at 40°C. [104°F.] and 22·86 per cent. at 45°C. [113°F.]. The results indicate that the degree of response of the larvae is in proportion to the number of degrees rise in temperature within certain limits ; in the last series the rise from the incubator temperature to 45°C. gave a greater stimulus, and therefore a greater response, than the rise to 40°C., even though the former temperature is above the optimum. In neither of the last two series was a test made with water at 42·5°C. The high percentages of hatching obtained when the eggs were gently submerged shows that friction is not a necessary stimulus, although it may be an aid under certain conditions. When eggs were placed in water that was gradually heated to 46°C. [114·8°F.] during 30–40 minutes or placed in an incubator in which the temperature was gradually raised to 50°C. during 30 minutes, the percentage that hatched was negligible. When eggs from a cool environment were dropped into dishes in an oven at temperatures ranging from 40 to 50°C., 44–100 per cent. hatched, but in the absence of free moisture the larvae are not generally able to emerge completely from the shell and die of desiccation.

In view of the necessity for destroying the eggs of this fly in the field in the autumn after oviposition has ceased [*cf. R.A.E.*, B **23** 105], experiments were undertaken in October and November 1933 and 1934 to test the effect of warm water applied to the coats of horses. Before treatment, random samples of eggs were clipped from various parts of each horse to act as checks. Immediately after each treatment (or within 24 hours) another sample was removed and examined microscopically to determine the percentage hatch. The water was heated to 45–48°C. [113–118·4°F.] (and in no test did it drop below 40°C.) and applied by dipping a sponge or piece of cloth frequently (to keep within the range of temperature required) and bathing the infested parts of the coat with slow firm movements backwards and forwards, the pressure and friction aiding in the penetration of the heat. About 2 U.S. gals. were necessary to treat each horse, but it was found desirable to use a large pail holding more than this amount to maintain the heat. One horse could be treated in 5 minutes. The average hatch in tests with 37 horses was 94·96 per cent. when the air temperature was as low as 60°F.

Knowlton (G. F.). **Simuliids annoy Livestock.**—*J. econ. Ent.* **28** no. 6 p. 1073. Geneva, N.Y., December 1935.

During August 1934 *Simulium bivittatum*, Mall., *S. vittatum*, Zett., and *S. venator*, Dyar & Shannon, caused considerable annoyance to

horses in certain localities in southern Idaho. *S. vittatum* was observed attacking horses in large numbers in October 1933 in a locality in Utah.

HOYER (D. G.) & WEED (A.). **Pyrocatechin as a protecting Agent for the active Principles of Pyrethrum in finished Fly-Sprays and Concentrates.**—*J. econ. Ent.* **28** no. 6 pp. 1074–1075, 1 ref. Geneva, N.Y., December 1935.

A study was made of the value of one of the stabilisers or anti-oxidants (known commercially as Pyrocatechin) that are claimed to protect pyrethrins against oxidation or other forms of deterioration. It was tested in a diluted fly-spray and a kerosene concentrate made by the cold direct process of extraction. The data given show only 0·33 and 0·37 per cent. loss of active principle or pyrethrin content in the unprotected concentrate and spray respectively after 9 months' storage. The figures for the protected samples were 0·26 and 0·23 per cent.

FERRIÈRE (C.). **Descriptions de deux importants Chalcidiens d'Egypte et du Soudan.**—*Bull. Soc. R. ent. Égypte* **19** pp. 365–370, 3 figs. Cairo, 1935.

One of the two new species described in this paper [*cf. R.A.E.*, A **24** 188] is *Dirhinus wohlfahrtiae*, which attacks the pupae of *Wohlfahrtia nuba*, Wied., in Egypt and the Anglo-Egyptian Sudan, where the larvae of the host are often found in surface wounds of animals and man, particularly camel drivers. The characters distinguishing this Chalcid from *D. pachycerus*, Masi, are given.

Entomological Division.—*Rep. Dep. Hlth Palestine 1934* pp. 97–98. Jerusalem, 1935.

Only the more usual Anophelines were identified in Palestine in 1934 [*cf. R.A.E.*, B **20** 3 ; **18** 188], and the species of fleas and rats caught at the ports of Jaffa and Haifa were the same as those taken in the previous year [**22** 238].

PAPERS NOTICED BY TITLE ONLY.

EVANS (A. M.) & WALKER (G. R.). **Notes on Brazilian Mosquitoes : Species observed in the Amazon Valley, and Record of *Aëdes albifasciatus* Macq. invading a Ship in Harbour.**—*Ann. trop. Med. Parasit.* **29** no. 4 pp. 463–467, 1 fig., 9 refs. Liverpool, 18th December 1935.

PATTON (W. S.) & WAINWRIGHT (C. J.). **The British Species of the Subfamily Sarcophaginae, with Illustrations of the Male and Female Terminalia.** [Part II.]—*Ann. trop. Med. Parasit.* **29** no. 4 pp. 517–532, 11 figs. Liverpool, 18th December 1935. [*Cf. R.A.E.*, B **23** 191.]

ROWE (J. A.) & KNOWLTON (G. F.). **The Genus *Tabanus* in Utah** [description of one new species and key].—*Canad. Ent.* **67** no. 11 pp. 238–244, 10 figs. Orillia, November 1935.

SÉGUY (E.). **Un nouveau tabanide** [*Thaumastocera cervaria*, sp. n.] **du Congo Belge.**—*Encycl. ent.* B II Dipt. **8** pp. 1–2, 1 fig. Paris, 1935.

GOETGHEBUER (M.). **Ceratopogonidae et Chironomidae nouveaux ou peu connus d'Europe. 6e Note.**—*Encycl. ent.* B II Dipt. **8** pp. 3–14, 16 figs. Paris, 1935.

GOETGHEBUER (M.). **Cératopogonides récoltés par le Dr. De Wulf au Congo belge** [with keys and descriptions of many new species].—*Rev. Zool. Bot. afr.* **27** fasc. 2 pp. 145–181, 41 figs. Brussels, 1935. **Chironomides du Congo belge.**—*T.c.* fasc. 3–4 pp. 351–366, 17 figs.

BEQUAERT (J.). **Notes on Hippoboscidae. 9. A further Study of** *Pseudolynchia* [recognising four species].—*Rev. Zool. Bot. afr.* **27** fasc. 3–4 pp. 395–399, 1 fig., 4 refs. Brussels, 1935. [*Cf. R.A.E.*, B **14** 48.]

SZILÁDY (Z.). **Die ungarischen Dasselfliegen.** [The Hungarian Oestrids; keys to the 13 known species including a description of *Gastrophilus gammeli*, sp. n.] [*In Magyar.*]—*Állat. Közlem.* **32** no. 3–4 pp. 136–140. Budapest, 1935. (With a Summary in German.)

[PAVLOVSKIĬ (E. N.), STEĬN (A. K.) & BUICHKOV (V. A.).] **Павловский (Е. Н.), Штейн (А. К.) и Бычков (В. А.). Experimentelle Untersuchung an der Wirkung des Speichels der Larve von** *Calliphora erythrocephala* **auf die Hautdecke des Menschen.** [Experimental Investigation on the Effect of the Saliva of the Larva of *C. erythrocephala*, Mg., on the dermal Tissue of Man.] [*In Russian.*]—*Mag. Parasit.* **4** pp. 99–110, 4 figs., 6 refs. Leningrad, 1934. (With a Summary in German.) [Recd. January 1936.]

DEONIER (C. C.) & RICHARDSON (C. H.). **The tarsal Chemoreceptor Response of the Housefly,** *Musca domestica* **L., to Sucrose and Levulose.**—*Ann. ent. Soc. Amer.* **28** no. 4 pp. 467–474, 9 refs. Columbus, Ohio, December 1935.

JAMES (J. F.). **A simple Fly Trap.**—*J. R. Army med. Cps* **65** no. 6 pp. 400–401, 2 figs. London, December 1935. [See *R.A.E.*, B **23** 124.]

HSU (Yin-chi). **A second new Species of Bat Flea** [*Ischnopsyllus wui*, sp. n.] **from Soochow.**—*Peking nat. Hist. Bull.* **10** pt. 2 pp. 137–139, 1 fig., 4 refs. Peiping, December 1935.

RAU (P.). **The Wasp,** *Chalybion cyaneum* **Fab.** [*Sceliphron coeruleum*, L.], **preys upon the Black Widow Spider,** *Latrodectus mactans* **Fab. (Hymen., Araneae)** [in Missouri].—*Ent. News* **46** no. 10 pp. 259–260. Philadelphia, Pa, December 1935. [*Cf. R.A.E.*, B **23** 305.]

SERGENT (Ed.), DONATIEN (A.), PARROT (L.) & LESTOQUARD (F.). **Au sujet de la classification des piroplasmes du boeuf. Le genre** *Piroplasma* **et son sous-genre** *Babesiella.*—*J. comp. Path.* **48** pt. 4 pp. 261–266, 1 fldg pl., 1 fig., 5 refs. Croydon, December 1935.

List of Publications on Indian Entomology, 1934.—*Misc. Bull. imp. Coun. agric. Res.* no. 7, 38 pp. Delhi, April 1935. Price 2*s*. [Recd. February 1936.]

ROBERTS (J. I.). **The Relationship of the Cotton Crop to Plague, and its Rôle as a Vehicle for Rats and Fleas in East Africa.**—*J. Hyg.* **35** no. 3 pp. 388–403, 1 graph, 7 refs. Cambridge, 30th August 1935. [Recd. December 1935.]

All exports and imports for Kenya and Uganda, which are the worst plague centres in East Africa, are dealt with at the port of Mombasa. It would therefore seem probable that if the incidence of plague were related to the transport of cotton and maize, cases in the port would be associated with the period of export of these crops. Actually no plague was reported from Mombasa in 1929 or 1931 and the three cases in 1930 occurred in June, August and September, although the main export season extends roughly from January to June; moreover, two of the cases were found to be recent immigrants from Nairobi.

A rat-flea survey of Mombasa was carried out for 8 months in 1930 [*cf. R.A.E.*, B **20** 129]. *Mus* (*Rattus*) *rattus* was trapped in almost equal numbers in permanent types of buildings and in native huts. The average number of *Xenopsylla brasiliensis*, Baker, per rat was 1·8, whereas that of *X. cheopis*, Roths., was 0·9. Other fleas taken on this rat were *Echidnophaga gallinacea*, Westw., and small numbers of *Dinopsyllus lypusus*, J. & R., *X. humilis*, Jord., *X. crinita*, J. & R., and *Ctenophthalmus cabirus*, J. & R. *Mus* (*R.*) *norvegicus*, which was much less numerous, was found to harbour more *X. cheopis* than *X. brasiliensis*, the average numbers per rat being 1·4 and 0·5 respectively; the only other fleas found on this rat were *D. lypusus* and *E. gallinacea*. *X. humilis*, *X. brasiliensis* and *X. cheopis* were taken in small numbers on *Tatera mombasae*, and *X. cheopis*, *X. crinita*, and *Ctenocephalides* (*Ctenocephalus*) *felis strongylus*, Jord., on *Cricetomys gambianus*.

Details are given of investigations undertaken in 1932, which showed that the possibility of the carriage of rats and their fleas in cotton seed from Uganda is remote and that rats are poisoned by a diet of cotton seed [*cf.* **22** 170]. In a small cotton-growing area close to the Uganda border, surveys were made at the railway station and in the native reserve in various villages. At the station, rats were caught in the general store and in living quarters but not in the warehouse where cotton seed was in storage preparatory to being transported by train to Mombasa; in the reserve, nearly all rats were taken in living quarters, only 3 being trapped in stores where cotton seed and cereals were kept in cribs or earthenware pots. *X. cheopis* was present on rats from the station and absent on those from the reserve.

It is concluded that the cotton seed exported from Kenya and Uganda is of no importance in the dissemination of plague.

SYMES (C. B.). **Insects in Aeroplanes. A brief Report and Suggestions.**—*Rec. med. Res. Lab. Kenya* no. 6, 16 pp., 4 figs. Nairobi, 1935.

After recording the distribution in Kenya, Uganda and the Anglo-Egyptian Sudan of *Aëdes aegypti*, L., and mosquitos that have transmitted yellow fever experimentally, the author gives tables showing the numbers of insects of different kinds caught in aeroplanes examined at Kisumu and Nairobi [*cf. R.A.E.*, B **22** 175] during various periods in 1933 and 1934 and in the hangar at Kisumu during the early part of 1934. The Culicines taken were mostly of the group of *Culex pipiens*, L., with an occasional example of the genus *Mansonia*; no species of

Aëdes was taken (although a single specimen of *A. argenteopunctatus*, Theo., was collected from an aeroplane in April 1935). The data indicate that in spite of control methods now in use at various airports (routine spraying of aeroplanes was begun at Juba and Entebbe during or shortly after June 1934) insects are still being carried in serious numbers. Complete fumigation of an aeroplane with hydrocyanic acid gas can be carried out in two hours or less with little if any inconvenience to traffic, but it is necessary to provide an effective means of dispersing the gas quickly and completely after fumigation. An account is given of two experiments carried out to test the efficacy of an air blower consisting essentially of a large fan driven by a motor cycle engine to which was attached 30 feet of canvas hose with a tin nozzle. Promising results were obtained. Although fumigation will kill all insects in the aeroplane at the time, it will not prevent re-infestation, and should therefore be carried out as near the time of departure as possible. The aeroplanes should be made insect-proof and provided with insect-proof doors and windows that can be kept closed while in the airport. As an immediate measure of protection at Kisumu, large insect traps of mosquito gauze on a light framework have been constructed to fit closely against the sides of an aeroplane over the doors to the compartments, so that passengers and luggage are disembarked into them and insects flying out are caught. It is suggested that it should be made compulsory to give warning of the intended arrival of aircraft (other than those regularly using airports) so that measures could be taken by health authorities to ascertain whether they were likely to be concerned in disease transmission. The necessity for devising adequate precautionary measures while the air traffic is still relatively small to avoid serious trouble in the future is emphasised. A complete sanitary and mosquito survey should be made of all aerodromes on or connected with the African air route, and an attempt should be made to render them free from insects and rats. A greater degree of co-operation between airport health authorities is also urged.

MORISHITA (K.). **An experimental Study on the Life History and Biology of** *Trypanosoma conorhini* **(Donovan), occurring in the Alimentary Tract of** *Triatoma rubrofasciata* **(de Geer) in Formosa.** —*Jap. J. Zool.* **6** no. 3 pp. 459–546, 8 pls., 5 figs., 4 pp. refs. Tokyo, November 1935.

A detailed account is given of the morphology and biology of *Trypanosoma conorhini*, which commonly infests *Triatoma rubrofasciata*, DeG., in Formosa [*cf. R.A.E.*, B **17** 61 ; **18** 45]. It is not pathogenic to rats and mice that have been experimentally infected with it. Its natural vertebrate host is not known, but the high rate of natural infection in *T. rubrofasciata* suggests that it is transmitted directly from insect to insect either by their attacking one another or by faecal contamination ; hereditary infection has not been observed.

[KOLOSOV (Yu. M.).] **Колосов (Ю. М.). What is** *Pulex typhlus* **Motschulsky ?** [*In Russian.*]—*Bull. Soc. Nat. Moscou* **44** no. 4 pp. 178–181, 6 refs. Moscow, 1935. Also in German in *Ent. NachrBl.* **9** no. 4 pp. 206–211, 2 figs., 8 refs. Troppau, December 1935.

The author discusses the identity of *Pulex typhlus*, Motsch. (1840), which is generally considered to be unidentifiable. Though he agrees

that the description does not permit of identification, he considers that distribution and host show that the species is the one subsequently described as *Ctenophthalmus spalacis*, J. & R. Contrary views include those of Taschenberg who considered *typhlus* to be the flea described by him in 1880 as *C.* (*Typhlopsylla*) *caucasicus*, and Ioff who considered it a species of the subfamily CERATOPHYLLINAE, though specifically unidentifiable.

[TIKHOMIROVA (M. M.), ZAGORSKAYA (M. V.) & IL'IN (B. V.).] **Тихомирова (М. М.), Загорская (М. В.) и Ильин (Б. В.). Die Nager und ihre Flöhe im Steppen-Uebergangs-Landstrich der Nowo-Kasansker und Slomichinsker Rayons und ihre Rolle in der Epidemiologie der Pest.** [Rodents and their Fleas in the Steppe, transitional and sandy Tracts of the Districts of Novo-Kazanka and Slomikhino and their Rôle in the Epidemiology of Plague.] [*In Russian.*]—*Rev. Microbiol.* **14** no. 3 pp. 231–254, 1 map, 2 graphs., 34 refs. Saratov, 1935. (With a Summary in German.)

An account is given of investigations carried out in 1926–34 in western Kazakstan between the Lower Volga and the river Ural on fleas occurring on animals and man and their relation to plague [*cf. R.A.E.*, B **16** 222; **23** 84]. The three different zones that constitute the region, the steppe, the sands and an intermediate zone, are briefly described, and a list is given of the 25 species of animals (practically all rodents) found there, showing their distribution. All the species were present in the intermediate zone, 18 in the steppe, with *Citellus pygmaeus* predominating, and only 7 species in the sands, where *Meriones* (*Pallasiomys*) *meridianus* constituted about 70 per cent. of the total number. Over 80,000 fleas, comprising 22 species, were examined; the majority was collected from 2,750 nests of rodents.

The hosts and distribution of the individual species in each zone are discussed. The greatest variety of fleas was found in the intermediate zone, where they readily passed from one host to another and came into close contact with man [**23** 84]. Thus, 13 additional species were taken there from the nests of *C. pygmaeus* besides the five that were specific to this rodent in the steppe zone, *viz.*: *Neopsylla setosa*, Wagn., *Ceratophyllus tesquorum*, Wagn., *Ctenophthalmus breviatus*, Wagn. & Ioff, *C. pollex*, Wagn. & Ioff, and *Frontopsylla semura*, Wagn. & Ioff [*cf.* **16** 223; **21** 161]; and the nests of *M. meridianus* harboured 12 species as compared with only 3 (*Ceratophyllus mokrzeckyi*, Wagn., *C. laeviceps*, Wagn., and *Xenopsylla conformis*, Wagn.) in the sands. Plague bacilli were obtained from *N. setosa* taken on *Citellus pygmaeus* in the steppe in May and from *Ceratophyllus mokrzeckyi* taken on *Meriones meridianus* in the sands in October. Both these fleas were found on man.

In the steppe zone plague epizootics occur in the summer and chiefly among *Citellus pygmaeus*, whereas in the other zones they take place throughout the year among most of the species of rodents found there. Fleas were most numerous in the nests of *C. pygmaeus* in May and September. The increase in May is of special importance, as it coincides with the beginning of epizootics among the ground squirrels. In July–August, however, practically all the fleas die out and only a few remain in the nests. Thus the fleas of this rodent do not live long enough to act as reservoirs of plague bacilli from

one summer to the next [*cf.* **20** 249; **21** 160], and it appears that they can only transmit infection during, and shortly after, the epizootics. The increase in the numbers of fleas in September is not important as regards plague, as then the epizootics among the ground squirrels die out and the animals enter hibernation.

It is concluded that the sandy zone should be considered as an independent enzootic focus of plague among *Meriones meridianus* and the jerboa, *Dipus sagitta*, in view of the frequency of epizootics there, the complete absence of *C. pygmaeus* and the ability of *M. meridianus* to harbour infection for protracted periods [**23** 85]. Plague epizootics among ground squirrels in the steppe zone originate in the intermediate zone, from which they spread to the steppe by means of fleas.

[Pokrovskiĭ (S. V.).] **Покровский (С. В.). Essai d'obtenir les pontes hibernales d'*Anopheles maculipennis* en conditions de laboratoire.** [*In Russian.*]—*Rev. Microbiol.* **14** no. 3 pp. 299–301. Saratov, 1935. (With a Summary in French.)

In experiments in Moscow in October–December 1934, females of *Anopheles maculipennis*, Mg., taken from hibernation quarters were induced to oviposit at temperatures of 19°C. [66·2°F.] and 26°C. [78·8°F.] after feeding on man. The engorged mosquitos were placed singly in small glass tubes covered with muslin on the top and placed in a tumbler containing a little water. The mosquitos lived longer and oviposited more readily at 19°C. The length of their life varied from 2 to 68 days, and the majority oviposited once only. The number of eggs in a batch varied from 12 to 248, with an average of 141, whereas the average in June and July was 279·2 eggs, with a maximum of 465. The structure of the eggs indicated that they belonged to the typical form and to var. *messeae*, Flni., which predominate in central Russia [*cf. R.A.E.*, B **23** 287]. In these experiments the average number of eggs in a batch was 150·9 for *messeae* and 112·6 for the typical form, whereas in summer the figures were 263 and 293, respectively.

[Pokrovskiĭ (S. V.).] **Покровский (С. В.). Matériaux pour l'étude de la faune d'Aphaniptères sur les rats de la ville de Moscou.** [*In Russian.*]—*Rev. Microbiol.* **14** no. 3 pp. 303–307, 3 graphs. Saratov, 1935. (With a Summary in French.)

In continuation of a rat-flea survey in Moscow in 1933 when it was found that *Xenopsylla cheopis*, Roths., constituted up to 81 per cent. of all the fleas taken on rats, further collections were made in 1934 in a larger number of divisions of the city. From the 797 examples of *Mus* (*Rattus*) *norvegicus* examined, 2,328 fleas were taken. Of these, 70·25 per cent. were *X. cheopis*, 29·60 per cent. *Ceratophyllus fasciatus*, Bosc, 0·12 per cent. *Leptopsylla segnis*, Schönh. (*musculi*, Dugès) and 0·03 per cent. *Pulex irritans*, L. On the whole, females considerably outnumbered males, though in some months the reverse was observed. The maximum number of fleas was collected in November. During the two years 1933 and 1934, *X. cheopis* and *C. fasciatus* represented 74·6 and 25·2 per cent. respectively of the 3,804 fleas collected, the former species predominating in all months except February and June.

[VLASOV (Ya. P.).] **Власов (Я. П.). The Bites of the Bugs,** *Entomocoris ululans* **Rossi and** *Reduvilus fedtschenkianus* **Osch.** [*In Russian.*]—*Rev. Microbiol.* **14** no. 3 pp. 315–317, 2 refs. Saratov, 1935. (With a Summary in English.)

Cases are described of painful bites by the Reduviids, *Ectomocoris ululans*, Rossi, and *Reduvius fedtschenkianus*, Osch., in south-western Turkmenistan.

[DANILOVA (M.) & POLOVODOVA (V.).] **Данилова (М.) и Половодова (В.). Biologie de l'***Anopheles maculipennis messeae* **Fall. près de Perm et la proportion d'individus des différents âges.** [*In Russian.*] —*Med. Parasit.* **4** no. 5 pp. 354–368, 6 graphs, 13 refs. Moscow, 1935. (With a Summary in French.)

An account is given of observations in the environs of Perm in 1934 and the winter of 1934–35 on *Anopheles maculipennis messeae*, Flni., the only Anopheline that occurred there. In the summer, small wooden sheds for cattle were the chief day-time shelters of the mosquitos, which were rare in large well-aired sheds and in dry well-heated houses. Shelters used for one day comprised latrines, bridges, stacked timber, open sheds for machines, etc. The mosquitos were most numerous in day-time shelters in the second half of July, and a sharp decrease in their numbers occurred in the second half of August, when the young ones made their way to hibernation quarters and the others died. Hibernation took place chiefly in basements of inhabited houses and less frequently in warm cattle sheds and stables.

In the course of the investigation, large numbers of mosquitos were dissected and their oviducts measured by the method of Mer [*R.A.E.*, B **21** 71] to determine their physiological age. Most of the hibernating mosquitos were females that had never laid eggs, though a few had oviposited once or twice. They began to abandon their hibernation quarters in the last ten days in April. Overwintered females with mature eggs predominated at the end of May, when oviposition was intense, and young females of the first generation and males in the first half of June. The flight, feeding and maturation of eggs occupied 10–12 days, and oviposition was again very intense about 19th June. The last overwintered females disappeared in the beginning of July. In the course of the whole summer 90–95 per cent. of the mosquitos in cattle sheds were females that contained blood or mature eggs, and 2–4 per cent. were males. Of those entering the sheds 4½ per cent. were males, and there were no females with completely mature eggs. Most of the mosquitos leaving the shelters in summer or autumn contained mature eggs, but in autumn 24 per cent. had a developed fat-body. The exit invariably took place in the evening and depended on the time of sunset.

In the course of the dissections, a few mosquitos infected with malaria were found for the first time in the Perm region, the oöcyst index being 0·16 per cent. Four of the eight females that contained oöcysts had large oviducts, which indicated a physiological age that is reached by only a negligible percentage of the Anophelines. It seems, therefore, that only a few infected mosquitos could live long enough for sporozoites to develop in them.

[Shmeleva (Yu. D.).] **Шмелева (Ю. Д.). Sur la biologie d'*Anopheles maculipennis messeae* Fall. près de Moscou.** [*In Russian.*]—*Med. Parasit.* **4** no. 5 pp. 369–376, 3 graphs, 5 refs. Moscow, 1935. (With a Summary in French.)

Investigations carried out in a sedge peat district in the Department of Moscow in 1933 [*R.A.E.*, B **23** 108, 112] were continued in June–September 1934, when a study was made of the physiological condition of the adults of *Anopheles maculipennis messeae*, Flni., that occurred in resting places. The latter comprised cow-sheds, workmen's huts and tents, and latrines. Only a negligible number of unfed mosquitos occurred in cow-sheds, whereas freshly engorged females were abundant ; those with completely mature eggs were rare, as they probably abandoned the sheds during the night. In the huts, which were screened, the number of unengorged mosquitos was considerably higher, as was also the percentage of females with fully developed eggs, probably because they could not find an exit. In the tents, conditions were unfavourable for mosquitos as the temperature there reached 33–33·5°C. [91·4–92·3°F.] and the humidity 58–63 per cent. The vast majority of the mosquitos taken in latrines were unengorged, and the percentage of males was higher than in other shelters. Of the mosquitos caught while entering cow-sheds and workmen's huts, 97·9 per cent. were unengorged females, which indicates that they seldom feed outdoors in this locality. Of the mosquitos that abandoned cow-sheds, 12·7 per cent. were unfed and 77 per cent. were ready to oviposit, the corresponding figures for the huts being 25·8 and 62·9.

The maximum flight into the shelters occurred during the first half of the night ; newly emerged females entered the shelters only in the evening, whereas those that had oviposited, but had not subsequently fed, entered during the whole night.

[Shipitzina (N. K.).] **Шипицина (Н. К.). Grandeur maximum et minimum des particles pouvant être avalées par les larves d'*Anopheles maculipennis messeae*.** [*In Russian.*]—*Med. Parasit.* **4** no. 5 pp. 381–389, 16 refs. Moscow, 1935. (With a Summary in French.)

In view of the use of dust insecticides against Anopheline larvae, experiments were undertaken in Moscow to determine the size of the particles that are swallowed by larvae of *Anopheles maculipennis messeae*, Flni., in various instars. For this purpose quartz sand of varying degrees of fineness was scattered on the surface of water in glass vials in which larvae of different instars were placed. After the larvae had filtered the water for several hours, they were dissected and the largest particles of sand found in them were measured. The results for 102 larvae are given in a table showing the width of the head of the larvae at the base of the collar, the maximum size of the particles swallowed, and the mean relation of the size to the width of the larval head. The size of the particles swallowed by the first instar larvae varied from 22·8 to 34·2 μ, their diameter being about 20 per cent. of the width of the head of the larva. This percentage increased with each moult, and larvae of the fourth instar swallowed particles varying from 68 to 165·3 μ in size and representing 31·2 per cent. of the width of head. Paris green manufactured in the Russian Union largely consists of particles not exceeding 20 μ and thus can easily be swallowed even by the first instar larvae.

In tests to establish the minimum size of the colloidal particles that the larvae are able to catch [*cf. R.A.E.*, B **19** 25 ; **20** 173, 201], solutions of colloidal gold and haemoglobin were used. Examination of the digestive tract showed that the larvae retain fractions of colloidal gold, measuring 26–31·5 μμ, but not of haemoglobin, the particles of which measure 2–4 μμ.

[BEKMAN (A. M.). **Бекман (А. М.). Interruptions dans la nutrition des larves d'***Anopheles maculipennis*, **occasionnées par les mues.** [*In Russian.*]—*Med. Parasit.* **4** no. 4 pp. 389–391, 2 figs., 2 refs. Moscow, 1935. (With a Summary in French.)

To verify the assumption that mature larvae of *Anopheles maculipennis*, Mg., suspend feeding shortly before pupating, since some of them often survive after the water has been dusted with an insecticide that kills all the other larvae, laboratory observations were carried out on the feeding of the larvae of all instars, some of which were taken in the field and some bred in the laboratory. The larvae were kept singly in small glass vials in water at 19–22°C. [66·2–71·6°F.], and their behaviour was observed for 5 minutes at a time at frequent intervals. In each instar there were fluctuations in the intensity of feeding, which ceased both before and after each moult. First instar larvae began filtration 60–150 minutes after hatching, and suspended it for 40–300 minutes before moulting. Larvae of the 2nd, 3rd and 4th instars resumed feeding 40–60 minutes after the moult. They ceased to feed for 65–225 minutes before the second moult, 20–30 before the third, and 90–360 before pupation.

[VEĬSIG (S. Ya.).] **Вейсиг (С. Я.). On the Hibernation of the Larvae of** *Anopheles plumbeus* **Steph.** [*In Russian.*]—*Med. Parasit.* **4** no. 5 pp. 392–393. Moscow, 1935.

Water in a tree hole in south-eastern Azerbaijan, in which larvae of *Anopheles plumbeus*, Steph., and *Aëdes geniculatus*, Ol., had been found in the previous summer, was examined in January 1935, the winter being unusually severe. It had been frozen for at least a week and was covered with a layer of ice 9 ins. deep. The reddish-brown water beneath it, which was about 3 ins. deep, was found to contain larvae of Chironomids, Syrphids and Cyphonids, 50 per cent. of which were alive, fourth instar larvae of *Aëdes geniculatus*, all of which were dead, and third instar larvae of *Anopheles plumbeus*, all of which were alive. Studies of the physiology of respiration of the hibernating larvae of *A. plumbeus*, which can survive for a long period without contact with atmospheric oxygen, and the rôle of the anal gills are recommended.

[DERBENEVA-UKHOVA (V. P.).] **Дербенева-Ухова (В. П.). Die Einwirkung der Imaginalen Ernährungsbedingungen auf die Entwicklung der Ovarien von** *Musca domestica*, **L.** [The Influence of the Conditions of Adult Feeding on the Development of the Ovaries of *M. domestica*.] [*In Russian.*]—*Med. Parasit.* **4** no. 5 pp. 394–403, 6 graphs, 8 refs. Moscow, 1935. (With a Summary in German.)

A detailed account is given of experiments to determine the influence of nutrition on the development of the eggs of *Musca domestica*, L

Newly emerged unfertilised females were kept in covered glass tumblers at 26°C. [78·8°F.] and a relative humidity of 40–45 per cent., and supplied with various types of food. The maturation of the eggs was observed by daily dissections of the flies and measurements of the first follicle of the egg tube. The results are shown in graphs. In flies supplied with water or water and albumen (white of egg) only, the first follicle grew during the first 24 hours at the expense of the unused remains of histolysis ; then development stopped, and all flies died by the 4th day. In flies supplied with such complete food as milk, the eggs become fully mature in 5 days, the most intense development taking place between the 3rd and 4th days. During the first 24 hours, however, the rate of development of the follicle was exactly the same as when the flies were starved, showing that in the beginning, even in the presence of food, growth occurs at the expense of internal resources. The percentage mortality of the flies did not exceed 4·5. Flies fed only on carbohydrates (20 per cent. sugar solution) survived, but their ova did not develop. When given fats (vegetable oil and butter) and water, 86·2 per cent. of the flies died within 24 hours and the remainder on the following day. This was probably due to the blocking of the tracheae with fat. The development of the follicle was negligible. A combined diet of albumen and carbohydrates caused the eggs to develop, though rather more slowly than when complete food was supplied, the peak of the curve of development being reached in 7 days instead of 5. When fat was added to a diet of albumen or carbohydrates, the eggs did not develop and the rate of mortality markedly increased.

It was found that as new follicles develop in the fly, the growth of each is suspended from the moment the eggs of the preceding one reach maturity until they are laid ; this indicates that the follicle has two cycles of development.

[DERBENEVA-UKHOVA (V. P.).] **Дербенева-Ухова (В. П.). Ueber die Zahl der Generationen bei** *Musca domestica* **L.** [On the Number of Generations of *M. domestica*.] [*In Russian.*]—*Med. Parasit.* **4** no. 5 pp. 404–407, 1 graph, 7 refs. Moscow, 1935. (With a Summary in German.)

An attempt was made in 1934 to ascertain experimentally the number of annual generations of *Musca domestica*, L., that occur in Moscow in connection with the changes in temperature and humidity in the course of the summer. For this purpose, adult flies were placed in insectaries with a supply of milk and a tumbler containing dung for oviposition. As soon as the eggs were laid, they were transferred to a deep glass dish with sand at the bottom covered with a layer of dung ; fresh dung was added at least every other day. After the emergence of young adults, the dish was removed and a tumbler containing fresh dung supplied for oviposition. The results of observations are given in a graph showing the succession of stages and generations from 20th May to the end of September and the fluctuations that took place in the mean daily temperature and in the mean temperature and humidity during the development of individual stages. There were four generations, development being accelerated by an increase of temperature combined with a decrease of relative humidity. Thus, the duration of the first and second instars was 2 days in the first generation at a mean temperature of over 20°C. [68°F.] and 55 per

cent. humidity, 8 days in the second at 15·5°C. [59·9°F.] and 79 per cent., and 4 days in the third and fourth at 16·5°C. and 17·3°C. [61·7°F. and 63·14°F.] and 80 and 74 per cent., respectively. The pupal stage lasted 10 days in the second generation at 20·3°C. [68·54°F.] and 76 per cent. humidity, and 12 days in the third generation at 19·3°C. [66·74°F.] and 75 per cent. The fourth generation was in the pupal stage in September when the average temperature dropped to 10·9°C. [51·62°F.] and the humidity was 78 per cent. No adults emerged, the pupae apparently entering hibernation.

[ENIKOLOPOV (S. K.).] **Ениколопов (С. К.). Observations on the Biology of *Gambusia* that have been acclimatised in Daghestan.** [*In Russian.*]—*Med. Parasit.* **4** no. 5 pp. 408–413, 2 figs., 2 refs. Moscow, 1935.

Since its introduction for the control of mosquito larvae in Daghestan in 1928, *Gambusia* has become well established and widely distributed in the plain. There are now 8 permanent breeding ponds in which the fish hibernate and from which they are sent to other districts. Observations in concrete tanks in the town of Makhach-Kala on the Caspian Sea, showed that a female may produce up to 6 broods comprising a total of over 920 young between mid-June and the beginning of September, the intervals between broods being 21–25 days during the first 3 months. In the course of the summer, the fish of the first and second broods also produce offspring. The maximum production of young occurred in the beginning of June at a mean temperature of 15°C. [59°F.]. Two or three broods could be produced after one fertilisation, which is of importance, since no males may occur among the few fish that are frequently liberated in small pools in the country, though the sex ratio was found to be 1 : 1. Sexual dimorphism became apparent 36 days after birth, and young fertilised females produced young 17 days later.

The development of the fish chiefly depends on the supply of food and to a less extent on the temperature. Fish in which the sexual characters had just become apparent readily swallowed mosquito larvae of the first three instars, but not those of the fourth instar or pupae. No cases of cannibalism occurred in reservoirs with an abundance of food, whereas if it was scarce and the water devoid of vegetation, all the young fish were eaten by the parents in less than 24 hours. In the course of a night an adult female was able to eat 94 pupae of *Aëdes*, or 109 fourth instar larvae of *Aëdes*, *Culex* and *Anopheles*. Fish one month old destroyed 20 fourth instar larvae of *Aëdes* in 24 hours. Young dissected from females that had just died continued to thrive [*cf.* *R.A.E.*, B **19** 26].

[BOGDANOVICH (I. N.).] **Богданович (И. Н.). The Reproduction and Acclimatisation of *Gambusia* in Turkmenistan.** [*In Russian.*] —*Med. Parasit.* **4** no. 5 pp. 413–416. Moscow, 1935.

Observations were carried out in 1930–34 in Turkmenistan on the acclimatisation of *Gambusia*, which was introduced in 1929. From a breeding pond in the west, large consignments of the fish were sent yearly to other localities and to Uzbekistan and Tadzhikistan. Brief notes on the habits of the fish and the method of breeding them are given. The young were produced from March to the end of September

at a water temperature of 18–35°C. [64·4–95°F.]. Only 8–15 were produced at a time by females 2–3 months old, and 60–100 by those 2–3 years old [*cf. R.A.E.*, B **19** 26]. Only the very young fish were devoured by the adults, those more than 5 days old not being attacked.

In Turkmenistan, where malaria is rife in many localities, the use of *Gambusia* against Anopheline larvae proved to be one of the cheapest and most reliable methods of controlling it.

de Buen (S.). **Contribución de los servicios antipalúdicos españoles al conocimiento de la biología de los anofeles.** [The Contribution of the Spanish anti-malarial Service to the Knowledge of the Biology of *Anopheles*.]—*Med. Países cálidos* **8** no. 12 pp. 574–593, 2 pp. refs. Madrid, December 1935.

This communication, presented to the Sixth International Congress of Entomology at Madrid in 1935, is a summary of studies made since 1920 by the Spanish anti-malarial services on the biology of Anophelines [*cf. R.A.E.*, B **19** 103; **20** 78; **21** 26, 123, 233; **22** 116, 166, etc.].

Lane (J.). **Notas sobre a distribuição geographica dos culicideos (Diptera) de São Paulo.** [Notes on the geographical Distribution of the Mosquitos of the State of S. Paulo, Brazil.]—*Rev. Biol. Hyg.* **4** no. 2 pp. 72–75. S. Paulo, August 1933. [Recd. January 1936.]

de Azevedo Antunes (P. C.) & Lane (J.). **Nota sobre a distribuição geographica dos culicideos (Diptera) de São Paulo (Brasil).**—*Ibid.* no. 3, December 1933, reprint 7 pp.; also as *Bol. Inst. Hig. S. Paulo* no. 50. [Recd. January 1936.]

In both papers particulars are given of the surroundings in which the various species were taken. The Anophelines recorded are *Anopheles tarsimaculatus*, Goeldi, *A. bachmanni*, Petrocchi, and *A. bellator* var. *cruzi*, D. & K., in both papers, *A. intermedius*, Chagas, in the first, and *A. albitarsis*, Arrib., *A. argyritarsis*, R.-D., *A. darlingi*, Root, *A. peryassui*, D. & K., *A. parvus*, Chagas, and *Chagasia fajardoi*, Lutz., in the second.

Soper (F. L.). **Some Notes on the Epidemiology of Yellow Fever in Brasil.**—*Rev. Hyg. Saude publ.* **8** nos. 2–3 pp. 37–61, 73–94, 3 figs., 21 maps, 1 chart, 3 refs. Rio de Janeiro, February–March 1934. [Recd. January 1936.]

The author contrasts the views on yellow fever in Brazil held in 1920 with those held in 1933, discusses methods by which the distribution of the disease may be ascertained, and gives an account of the outbreak in Espirito Santo in the absence of *Aëdes aegypti*, L. [*R.A.E.*, B **22** 72; *cf.* also **24** 34].

Curry (D. P.). **Report of Assistant Chief Health Officer.**—*Rep. Hlth Dep. Panama Canal 1934* pp. 12–16, 1 fig. Balboa Heights, C.Z., 1935.

The Madden dam was practically completed by the end of the year, and malaria was not a serious problem at any time during its construction, in spite of the fact that many of the employees were chronically infected and resided in neighbouring uncontrolled villages

to which they returned at frequent intervals. The practice of making monthly blood surveys of the personnel and the administration of quinine to all those found infected appeared to produce excellent results. Screening of quarters, mess rooms and amusement halls was also beneficial. Although measures against the larvae were carried out within a radius of a mile of the site of the dam, the densely wooded nature of most of the terrain limited greatly the amount of work necessary to control *Anopheles albimanus*, Wied. Hydraulic fills on the west side of the Panama Canal have now settled and consolidated sufficiently for mosquito breeding in them to be controlled by temporary ditches and oiling. Drainage in the large, marshy pastures east of Old Panama so reduced the numbers of *A. albimanus* that no aeroplane dusting was needed [*cf. R.A.E.*, B **22** 247]. In the Gatun and Miraflores lakes, Anophelines have been found breeding among plants other than *Chara* and *Utricularia* [*cf.* **23** 94] that have similar habits of growth, particularly several species of *Naias*. Copper sulphate, which was the most active of various weed killers used in attempts to destroy these plants in small selected areas, was only effective for a short period, the growth being back at the surface and as vigorous as ever 3 months after treatment. Of a number of animal and mechanical traps tested only a small screened shelter, containing a horse or mule, with apertures for the ingress of mosquitos was found to be effective for obtaining information on the density of flights.

Garbage and stable refuse are removed daily from all towns in the Canal Zone and from the cities of Colon and Panama. The results of the fly control measures are so remarkable that the presence of a single fly in a building causes comment, except at the onset (May–June) and the cessation (December) of the rainy season, when the house-fly [*Musca domestica*, L.] appears to breed more profusely and to have a wider range of dispersal [*cf.* **20** 109].

O'Connor (F. W.) & Hulse (C. R.). **Studies in Filariasis. I. In Puerto Rico.**—*P.R. J. publ. Hlth* **11** no. 2 pp. 167–367, 26 pls., 4 figs., 13 charts, 42 refs. San Juan, P.R., December 1935.

A detailed account is given of filariasis in Porto Rico (with a translation in Spanish pp. 273–367), based on observations made at different times in 1929, 1930 and 1931 [*cf. R.A.E.*, B **17** 115 ; **20** 158]. The disease is prevalent in parts of the Island where heat, moisture and rainfall are greatest but rare or absent in the hot dry area of the south and south-west. *Filaria* (*Wuchereria*) *bancrofti*, the causal agent, is transmitted by *Culex fatigans*, Wied., which is abundant, especially in the poorer sections of the towns. It is very numerous close to the sea front, where there is protection from the prevailing winds, and is troublesome even at an altitude of 2,000 feet, although at this height the disease is rare, possibly owing to the unfavourable effect of the atmospheric conditions on the longevity of the vector or on the ability of the parasite to develop in it. It breeds in swamps, ditches and open wells, in water in barrels or other containers, or in various receptacles on the extensive rubbish dumps. Under existing conditions the control of many of the breeding places is impossible.

The life-cycle of the mosquito varies with the season ; the pre-oviposition period and the egg, larval and pupal stages lasted 4–5, 1–2, 13 and 2 days, respectively, in March 1929, and 9, 2, 7 and 2 days in September 1930. Moreover, slight temporary changes in the weather

conditions may accelerate or delay development at any season. The adult mosquitos occur in great numbers in the dark and overcrowded houses or shacks of the poor, and they may also be found beneath the houses, especially those in damp sections or in the vicinity of breeding places. It was observed that filariasis was commonest amongst laundresses and their families, in whose houses damp clothes are dried. Mosquitos were found in greater numbers in the vicinity of such quarters than elsewhere, and dissection of those collected showed an unusually high average incidence of infection and more parasites in advanced stages of development. At all seasons, *C. fatigans* seems to feed most vigorously in the evening and early part of the night, at which times microfilariae are not numerous in the blood. In experiments, mosquitos that had not fed by 10 p.m. rarely did so later, unless sufficiently starved. This may explain the small number of filariae seen in most mosquitos, and the heavy infestations occasionally observed.

Experiments showed that the time required for the development of the parasite in the mosquito (from 11 to over 20 days) depends on weather conditions from day to day and is more rapid when temperature and humidity are high. In all studies young larvae were found in the thorax 24 hours after the infecting feed. The mature larvae have been found in many different parts of the body of the mosquito. Repeated attempts made to infect *Aëdes aegypti*, L., with *F. bancrofti* were unsuccessful. In a few instances larvae reached the thorax but degeneration began in 2–3 days. Microfilariae were invariably found in bedbugs [*Cimex*] collected from the beds of persons harbouring microfilariae in their blood, but in all cases they were dead in their sheaths.

Observations made on a large private estate not far from three towns in which filariasis is prevalent, revealed only three cases of the disease, all of which had probably become infected outside. The living conditions were good, the houses being clean and uncrowded. *Aëdes aegypti* was troublesome in sheltered localities during the day, *C. fatigans* was numerous and bit vigorously for some hours after sunset, and Anophelines, chiefly *Anopheles albimanus*, Wied., were active throughout the night. These findings support the observations of physicians that even in the plains the disease is rare and is therefore an urban rather than a rural problem.

In present circumstances preventive measures against the mosquito seem to be almost impossible, and the ultimate solution of the problem would appear to lie in the improvement in the economic condition of the people.

THORNTON (Sir E. N.). **Malaria ; Plague.**—*Rep. Dep. publ. Hlth S. Afr. 1934–35* pp. 29–34. Pretoria, 1935.

The successful results of malaria control work in Natal and Zululand [*cf. R.A.E.*, B **23** 8] have shown that with the proper organisation malaria can be prevented from becoming epidemic, not only in the limited sugar belt of these two countries, but also in the far more extensive and difficult native areas where nearly 1,000,000 persons are liable to become infected. If the present measures are maintained, it is believed that the disease can be practically eliminated in the country south of the Umhlatuzi River, Zululand, and in the controlled area north of it. Except in northern Zululand the incidence during

1934–35 has been low and the disease has been absent in some localities for the first time in their history. After two years' trial over extensive areas of country where other measures are impossible, it is concluded that malaria can be controlled by hut spraying with a pyrethrum insecticide provided that it is commenced as soon as adults of *Anopheles gambiae*, Giles, and *A. funestus*, Giles, begin to enter dwellings and that it is applied to every hut over as large an area as possible at least once, and preferably twice, a week. The effect is produced not by a diminution in the numbers of Anophelines but by a reduction in their rate of infection. This may be very marked. Among Anophelines engorged with human blood during the height of the malarial season it was found to be below 0·1 per cent. in native areas where the malaria incidence had formerly been high. Many natives are now convinced that fever is due to failure in controlling Anophelines, which they recognise, and have themselves begun to undertake drainage and restricted oiling and to plant gum trees (*Eucalyptus saligna*) on seepages near their kraals [*cf.* **19** 42].

In the bush-veldt area of the Transvaal, malaria occurs in definite epidemics during the summer. *A. gambiae*, which is the vector in this region, multiplies rapidly after rain. Data on rainfall obtained weekly from police posts made it possible to forecast probable epidemics in areas where adequate anti-mosquito measures are not carried out.

An epizootic of plague occurred among veldt rodents and in certain localities the incidence in man was high. Owing to the large amount of rat-proofing that has been carried out, urban centres were little affected. In the Orange Free State, where the disease was most prevalent, the summer of 1933–34 had been particularly favourable for the growth of the grasses on the seeds of which gerbilles feed and an enormous increase occurred among these rodents. In November 1934 waves of plague were reported to be destroying them, and the likelihood of domestic rodents becoming infected and so bringing about the infection of man was forecast. The incidence in man was highest in the south-western part of the Orange Free State where the Namaqua gerbille [*Desmodillus auricularis*] is abundant and the lobengula gerbille [*Tatera lobengulae*] is also found [*cf.* **15** 171]. The relative freedom of the northern part of the State may be attributed to the extensive destruction of veldt rodents in that area during the previous epizootic. The number of farms infected was very small compared to the extent of the epizootic, and this was probably due to the relative freedom of domestic rodents from infection. The chief intermediary between the gerbilles and man was the multimammate mouse [*Mastomys coucha*], although in a few instances *Mus* (*Rattus*) *rattus* was also involved. The floors of huts that could not be economically fumigated were dusted with calcium cyanide (cyanodust) [*cf.* **21** 30] and subsequently flamed with a blow lamp. Calcium cyanide in the form of calcid briquettes applied to rodent burrows by means of a rotary duster gave promising results.

BOOKER (C. G.). **Annual Report of the South African Railways and Harbours Health Organisation, 1934–35.**—*Rep. Dep. publ. Hlth S. Afr. 1934–35* pp. 79–98. Pretoria, 1935.

Anti-malaria work was continued on the same lines as in the previous year [*cf. R.A.E.*, B **23** 9]. From November 1934 to May 1935, 1,413

larvae and 603 adults of *Anopheles gambiae*, Giles, and *A. funestus*, Giles, were collected, together with 5,352 larvae and 412 pupae of other Anophelines. Wherever there was doubt as to the effectiveness of larval control, this measure was supplemented by spraying huts at intervals of a week or less until no further examples of *A. gambiae* could be caught. Where larval control was efficient within the specified radius but vectors continued to appear, anti-larval measures were extended. During the past two years screening has been increasingly used and most stations on the northern part of the coast of Natal have now been screened. The gauze used on the coast is monel metal with 16 wires to the linear inch 30 S.W.G. [*cf.* **23** 230]. In the Transvaal, bronze gauze is preferred. During the winter, when mosquito breeding is suspended, permanent anti-larval measures are undertaken ; a table is given showing the amount of drainage, filling and clearing carried out in Natal and the Transvaal. The malaria incidence has again diminished, the number of cases per 1,000 in Natal being 111 in 1933, 25·1 in 1934 and 13·6 in 1935. Data, also obtained from Natal, show that the incidence no longer follows fluctuations in rainfall, as it did prior to 1933, and that effective control has been maintained in spite of continuous rains and a favourable temperature (70°F. and over). Malaria has practically disappeared from the southern part of the coast of Natal and has been much reduced in the northern part.

A detailed account is given of the outbreak of plague [*cf.* preceding paper] and of the measures taken to prevent its spread. Particulars of all human and rodent infections are sent to the railway field staff in the areas concerned. A man is sent immediately to the station nearest the point of outbreak to disinfect all outgoing produce from neighbouring areas and so prevent the dissemination of rats or fleas, and ensure that the railway premises are free from rodents. The measures adopted in recent years have proved effective in preventing the spread of plague by rail, and not a single case in the present outbreak was found on railway premises or attributed to conveyance by rail. Much of the success attained has been due to the extensive rat-proofing that has been carried out during the past year, details of which are given.

TIMBRES (H. G.). **Studies on Malaria in Villages in Western Bengal.**—*Rec. Malar. Surv. India* **5** no. 4 pp. 345–370, 1 map, 5 graphs, 4 refs. Calcutta, December 1935.

A detailed account is given of a malaria survey carried out between 13th July 1932 and 31st March 1934 in 7 villages within an area of 9½ sq. miles in the District of Birbhum, Bengal, during which 154,260 adults and 7,154 larvae of Anophelines, comprising 15 species, were identified, and the salivary glands of 98,913 were examined.

The following is taken from the author's summary : The region is hyperendemic, but the intensity of malaria varied from village to village and, in some villages, from year to year. *Anopheles philippinensis*, Ludl., *A. annularis*, Wulp, and *A. pallidus*, Theo., were the only species found infected. The first was the chief vector in the summer and autumn. The last was the only one found infected in the cold-weather months (January and February) preceding the spring epidemic ; at this time the numbers of *A. philippinensis* were much reduced but those of *A. annularis* were high. *A. culicifacies*, Giles, *A. minimus*, Theo., and *A. aconitus*, Dön., which are vectors

in other parts of India, were relatively scarce and were never found infected. In each of the vectors the period of highest infectivity preceded by one to three months the season of maximum density; the highest sporozoite rates in *A. annularis* were obtained in July–August, in *A. philippinensis* in August–September and in *A. pallidus* in September. *A. philippinensis* was probably equally infected in the autumn seasons of both 1932 and 1933, but *A. pallidus* was more so in the first than the second and *A. annularis* in the second than the first. Comparisons of the seasonal prevalences of adults and larvae indicated that the pupal stage of *A. annularis* may have been considerably prolonged during the last 3 months of 1932, and that *A. barbirostris*, Wulp, is not a domestic mosquito. The three vectors bred only in still, clean, shady water with considerable aquatic vegetation. Rice-fields were not important breeding-places of any of the Anophelines. *A. philippinensis* definitely preferred human dwellings to cow-sheds. It apparently leaves houses during the day and returns to them at night, reaching its maximum density in the early hours of the morning (3–5 a.m.). The habits of *A. annularis* and *A. pallidus* are probably similar but are less pronounced. *A. hyrcanus* var. *nigerrimus*, Giles, *A. vagus*, Dön., and *A. subpictus*, Grassi, exhibit a preference for cow-sheds and are more often found in shelters during the day than during the night, a finding which suggests that they have sources of nourishment other than the blood of man or cattle. It is possible that there may be a connection between the preference of certain mosquitos for human habitations and the qualities in these mosquitos or their environment that make them vectors.

RICE (E. M.). **Observations on Malaria in Assam, with Special Reference to Cold Weather and Pre-monsoon Anti-larval Control.**—*Rec. Malar. Surv. India* **5** no. 4 pp. 371–388, 4 graphs, 16 refs. Calcutta, December 1935.

Although it has been recognised for many years that the general distribution of malaria intensity in towns, villages and tea estates in Assam is subject to great variation, measures against Anopheline larvae have been put into operation on the principle that the periods of transmission and the factors responsible are the same in all cases. Thus it is generally recommended that anti-larval measures should be started about 15th March and continued throughout the monsoon period up to November, that is, during the period when the malaria incidence is more or less intense. Observations made during malaria surveys of 19 towns and tea estates in the plains of the Brahmaputra Valley showed that the types of breeding places and the breeding periods of *Anopheles minimus*, Theo. (the only significant vector so far found in this area) have a direct bearing on the varying periods and degree of intensity of malaria.

Experimental work has shown that *A. minimus* continues to breed actively, although slowly, throughout the cold weather, and that the larvae found in perennial streams do not remain in a state of hibernation, but produce adults. In an experiment under conditions as natural as possible, 23 adults were reared from 192 eggs laid on 28th January, the egg, larval and pupal stages lasting 9, 17 and 4 days respectively. It has also been found that a blood meal is essential for pairing and the production of viable eggs. Thus adults emerging during the cold weather must take blood meals (and thus may ingest

gametocytes) if they are to lay fertile eggs. The gametocytes ingested in the coldest months (December and January) may fail to develop, or their development may be retarded so that they reach the sporozoite stage only with the rise of temperature in February. Other workers have not found either oöcysts or sporozoites during January, February or March, but during the present surveys out of only 104 dissections two females with oöcysts were found in January and one with sporozoites in February. These findings suggest that transmission may continue during the cold weather.

The areas surveyed were originally classed as healthy, moderately endemic and hyperendemic according to the spleen and parasite rate indices, but subsequent studies showed that the different gradations and periods of malaria intensity were due to the presence or absence of certain types of water and consequently the presence or absence of breeding of *A. minimus* at various times of the year. Hyperendemic areas are characterised by the presence of unpolluted, clear, perennial, running water in which a significant amount of breeding of *A. minimus* continues from October or November throughout the cold weather and pre-monsoon months until the advent of the monsoon rains in June, when these breeding-places are flushed ; by the presence during the monsoon and post-monsoon period of the same type of water in temporary streams, drains, etc., in which breeding continues from June until November or December ; by occasional breeding at any time of the year in unpolluted, perennial or monsoon clear water that is still ; by high spleen and parasite rates ; and by a malaria case-incidence curve that rises in March–May, reaches its peak in June or July, remains at a high level until October or November, and then falls until it reaches its lowest point in February. Moderately endemic areas are characterised by the presence of unpolluted clear running water from October or November until June ; by the almost complete absence of such water during and after the monsoon ; by the occasional breeding of the vector in still water from June to October or November ; by moderate spleen and parasite rates ; and by a malaria case-incidence curve that, after reaching its peak in June or July, falls until it reaches a low level by October and November and remains low until March. Healthy areas are characterised by the absence of any suitable running water within ½–2 miles of the surveyed areas ; by the absence of any significant or occasional breeding of the vector ; by low spleen rates ; and by a case-incidence curve that remains low throughout the year. Examples of each type of area are given.

From these observations it is concluded that it would be more economical to treat the breeding-places that occur in the endemic and hyper-endemic areas from early January to mid-June, for smaller areas of water would have to be dealt with. The measures that may be used are oiling, the application of Paris green, artificial flushing (where this is practical without producing scouring), polluting the water, the institution of dense shade and the prevention of the drifting of larvae into the controlled area [*cf. R.A.E.*, B **23** 194]. In hyper-endemic areas it is recommended that larval control measures should be extended to all breeding-places within 1–1½ miles of the periphery of the area to be controlled, in order to prevent the infiltration of adults from outside to the greatly extended breeding waters present during the monsoon months.

Most of the malarious areas in Assam, particularly in the case of villages, may be classed as moderately endemic, and in many instances

a single small stream is the main breeding-place. Thus if malaria can be controlled by the application of anti-larval measures to small areas of running water in the cold weather and pre-monsoon months, it may be economically possible to treat the bulk of the villages in Assam.

RICE (E. M.). **Anti-larval Oil Application by a " One Man " Brushing Method.**—*Rec. Malar. Surv. India* **5** no. 4 pp. 499–500, 1 pl., 2 refs. Calcutta, December 1935.

During 1935 Quaife's brushing method [*R.A.E.*, B **20** 121 ; **22** 148] was successfully used for the application of oil to streams and seepages in an area in Assam where *Anopheles minimus*, Theo., is the local vector of malaria. The larvae were killed, and the amount of oil required was reduced. A modification of a knapsack sprayer is described, in which a bamboo brush is attached to the nozzle from which the oil issues, thus enabling both oiling and brushing to be carried out by one man and so reducing the cost of labour.

RAYNAL (J.) & GASCHEN (H.). **Méthode des précipitines appliquée aux anophèles. Résultats en Indochine-Nord.**—*Bull. Soc. Path. exot.* **28** no. 10 pp. 937–943, 4 refs. Paris, 1935.

In studies of the feeding habits of the Anophelines of northern Indo-China, precipitin tests were carried out on most of the engorged females caught in dwellings and animal quarters in different parts of Tonkin and the western provinces of Annam and Laos (and in some instances in Yunnan) between March 1934 and February 1935.

At the time of capture, each female was identified and its stomach contents expressed on to a piece of filter paper. Salt solution extracts of each specimen were tested against precipitin sera prepared with the blood serum of man, cattle, buffalo, horse, pig, sheep, dog and fowl. The results are shown in tables. Taking into account only those species in which more than 100 reactions were observed, it is concluded that animal deviation occurs to a greater or less extent in all the species considered. Most of them are zoophilous, animal blood being found in 95–100 per cent. of the stomachs of *Anopheles vagus*, Dön., *A. hyrcanus* var. *sinensis*, Wied., *A. aconitus*, Dön., *A. subpictus*, Grassi, and *A. tessellatus*, Theo. On the other hand only 26 per cent. of those of *A. minimus*, Theo., and 41 per cent. of those of *A. jeyporiensis*, James, contained animal blood. These results corroborate those obtained in the southern part of Indo-China [*R.A.E.*, B **23** 80]. Anophelines previously recognised as important vectors of malaria in northern Indo-China (*minimus* and *jeyporiensis*) are found to contain human blood in a large proportion of cases and are most frequently found in human dwellings, whereas those that are poor or infrequent vectors, as well as those that are not known to transmit malaria, are much less prone to feed on man and are most often found in cow-sheds. A table shows the percentages of some of the local species that have been found naturally infected between 1st January 1931 and 1st March 1935, together with the percentages that contained human blood and that were caught in human dwellings. These three factors are clearly related, except in the case of *A. vagus* and *A. subpictus*. The high percentage of these species caught in houses is thought to

be due to the time at which collections were made ; if they had been made in the evening or at night, the proportions in animal sheds and houses would probably have been reversed. *A. vagus* has been observed to seek houses for shelter in the early hours of the morning, and the fact that *A. subpictus* was found in the coastal zone where man and animals live in very close contact may render the results obtained for this species misleading. As no female of *A. vagus* has ever been found to contain human blood in almost 1,000 tests, it seems probable that its infection with malaria is accidental [*cf.* **21** 140, 220].

TOUMANOFF (C.). **L'épreuve des précipitines appliquée à l'étude des habitudes trophiques chez quelques Culicines d'Extrême-Orient.**—*Bull. Soc. Path. exot.* **28** no. 10 pp. 943–948, 6 refs. Paris, 1935.

The author gives the results of precipitin tests carried out on the commoner species of Culicines in the delta of Cochin China that have been found sheltering in habitations or cattle-sheds. Of these species, *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.), *A. albopictus*, Skuse, etc., have been suspected of transmitting dengue and *Culex fatigans*, Wied., of being the vector of filariasis. The results show that these mosquitos and *Armigeres obturbans*, Wlk., even when taken in the vicinity of animals, were in most cases engorged with human blood. The findings cannot, however, be generalised, as Culicines, including *C. fatigans* and *A. obturbans*, taken in cattle sheds in Hong Kong, all contained bovine blood.

TOUMANOFF (C.). **Relations entre l'armement maxillaire et l'exploitation relative de l'homme ou des animaux par les espèces anophéliennes indochinoises.**—*Bull. Soc. Path. exot.* **28** no. 10 pp. 948–958, 6 diagrs. Paris, 1935.

A table shows the detailed results of precipitin tests on the stomach contents of nearly 5,000 examples of 16 species of *Anopheles* that were taken in southern Indo-China in dwellings, in animal shelters, near animals in the open, or in specially constructed stable-dwellings that will be described later. These completed results bear out those already published [*R.A.E.*, B **23** 80], but show even more clearly the zoophilous tendency of such species as *A. karwari*, James, *A. kochi*, Dön., *A. splendidus*, Koidz. (*maculipalpis*, auct.), *A. maculatus*, Theo., *A. philippinensis*, Ludl., and *A. tessellatus*, Theo.

A study of the maxillary indices of *A. hyrcanus* var. *sinensis*, Wied., *A. barbirostris*, Wulp, *A. jeyporiensis*, James, *A. aconitus*, Dön., *A. minimus*, Theo., and *A. sundaicus*, Rdnw., and of *A. vagus*, Dön., and *A. subpictus*, Grassi, together, in relation to the numbers containing human blood, showed that in each species the percentages containing human blood were highest in individuals with the lowest indices. On the other hand the zoophilous species previously mentioned are most often engorged with animal blood even though their maxillary indices are usually low [*cf.* **24** 47]. The presence of bovine blood in paucidentate species of the delta region may be due to their attacking buffalos [*cf.* **23** 80]. Moreover, in some of these species there is always a high percentage of individuals in which the maxillary indices attain and exceed 13.

Farinaud (M. E.). **La lutte contre le paludisme dans les colonies françaises.**—*Ann. Méd. Pharm. colon.* **33** no. 4 pp. 919–969. Paris, 1935.

In the first part of this paper the author reviews the malaria situation in the French colonies, giving information, where possible, on the adverse effect that the disease has had on the exploitation of the various regions. In the second part he briefly discusses the various methods of control. He concludes that, in order to be effective, anti-mosquito measures must be methodically and carefully applied and that they must be preceded by a study of local conditions. Moreover, he considers that they are more likely than other measures to prove successful in combating endemic malaria in communities of any size.

Parrot (L.). **Nouvelles recherches sur l'évolution de** *Leishmania tarentolae* **chez** *Phlebotomus minutus* **Rondani.**—*Bull. Soc. Path. exot.* **28** no. 10 pp. 958–960, 1 ref. Paris, 1935.

The results of further experiments on the infection of *Phlebotomus minutus*, Rond., with *Leishmania tarentolae* carried out at Biskra in May and September 1935, confirmed those previously obtained [*R.A.E.*, B **23** 44]. Of eight females of *P. parroti*, Adl. & Thdr., fed on the same infected gecko (*Tarentota mauritanica*) as those of *P. minutus*, one of the three dissected before digestion was completed was infected whereas the five dissected after were not ; of four females of *P. papatasii*, Scop., also fed on this gecko, one of the three dissected before digestion was completed was infected, whereas the one dissected after was not. These findings do not support the suggestion that the *Leishmania* is transmitted by the bites of these sandflies.

Parrot (L.). **Phlébotomes et végétation.**—*Bull. Soc. Path. exot.* **28** no. 10 pp. 960–963, 10 refs. Paris, 1935.

The author considers that, as the larvae of *Phlebotomus* feed on vegetable débris [*cf. R.A.E.*, B **21** 21], Maldonado [*cf.* **19** 112] is correct in assuming that there is a direct relation between *Phlebotomus* and vegetation in the Peruvian Andes, and, as the vegetation of this region is composed largely of Euphorbiaceae, it may be shown that these plants are the normal or preferred food. On the other hand, during long investigations on the habits of adults of many species of *Phlebotomus* in Algeria, the author made no observations that would lead him to suspect that they frequent euphorbiaceous plants or ingest their latex. The digestive tracts of the males caught in nature are invariably empty or contain only bubbles of gas, a finding suggesting that they do not feed ; moreover it has been shown in the course of breeding experiments that this state of inanition does not prevent them from pairing, or, frequently, from living longer than certain females that have fed. The females are either fasting or gravid, in which cases the digestive tract is empty, or engorged, in which case it never contains anything but blood. Thus, in spite of the record of *Bartonella* [*bacilliformis*] in the latex of a euphorbiaceous plant [*cf.* **23** 231], a finding that needs confirmation, the author considers that adult *Phlebotomus* would not be able to imbibe any transmissible organism, including that of verruga, from the latex of plants, and that it will be necessary to look elsewhere for the reservoir of the

disease. It is suggested that investigations should be made to determine whether persons that had recovered from the clinical manifestations of the disease might not continue to act as carriers of the causal organism.

HASEMAN (L.). **Insect Pests of the Household.**—*Bull. Mo. agric. Exp. Sta.* no. 356, 27 pp., 12 figs. Columbia, Mo., November 1935.

One section of this paper [*cf. R.A.E.*, A **24** 254] comprises notes on the habits and control of pests that attack man in houses in Missouri, including mosquitos, fleas, lice [*Pediculus* and *Phthirus pubis*, L.], bed-bugs [*Cimex*], etc.

MOHLER (J. R.). **Report of the Chief of the Bureau of Animal Industry, 19**[34–]**35.**—55 pp. Washington, D.C., U.S. Dep. Agric., 1935.

In the campaign for the eradication of the cattle fever tick [*Boophilus annulatus*, Say], a further area of more than 12,000 square miles was released from Federal Quarantine and no areas were re-quarantined. The quarantined area is now only 9 per cent. of its original size [*cf. R.A.E.*, B **23** 68] and is confined to parts of Florida, Louisiana and Texas.

In the central zone of an area in Colorado in which a campaign for the eradication of cattle grubs [*Hypoderma*] is being carried out, the average number of larvae per animal increased from 4·9 in the previous year [*cf. loc. cit.*] to 6·4, owing largely to lack of co-operation among cattle owners, to the importation of infested cattle during the drought, and to the invasion of flies from uncontrolled areas. In further experiments on the prevention of the carriage of infections by the medicated rods used in treatment [*loc. cit.*], it was found that the materials in the rods (glue, cocoa butter and derris powder in the proportions 1 : 1 : 2) when inoculated with virulent spores of malignant oedema or anthrax were sterilised by heating under pressure at 400°F. for 2 hours without affecting the action of the mixture on the larvae. Of a large number of chemicals tested, only colloidal iodine in the rods prevented development of spores of malignant oedema and none killed those of anthrax.

Investigations on *Oestrus ovis*, L., showed that a single deposit of larvae in the nostrils of lambs during the season of fly activity in New Mexico causes an infestation that may persist for at least 10 months. Some of the larvae may mature and emerge in 25 days and a large number in 65 days. Many remain in the first instar on the mucosa of the nasal passages for several months. Development of the larvae ceases between September and the end of December; more than 90 per cent. of those found in the heads of sheep during these months were in the first instar and 96 per cent. were in the nasal passages. After this time there were fewer larvae in the first instar and more in the second and third. Experiments with various nasal sprays and washes against the small larvae, and with chemicals and mechanical devices for preventing the fly from depositing larvae on the mucous membrane of the nasal passages yielded no satisfactory results.

In addition to *Ataenius cognatus*, Lec. [*cf.* **21** 118], two other dung beetles, *Choeridium histeroides*, Weber, from the District of Columbia

and *Ataenius stercorator*, F., from Porto Rico, were found to be intermediate hosts of the tapeworm of fowls, *Hymenolepis cantaniana*. Grasshoppers serve as intermediate hosts for the turkey cestode, *Metroliasthes lucida*.

A single application of a 1 per cent. derris powder (containing 5 per cent. rotenone) in kaolin destroyed *Haematopinus suis*, L., on pigs, *Bovicola bovis*, L. (*Trichodectes scalaris*, Nitzsch), on cattle, and *T. pilosus*, Giebel., on horses. It was effective against *H. suis* at half this strength, but to destroy all lice two applications were necessary.

On the Diagnosis, Treatment and Epidemiology of Visceral Leishmaniasis in the Mediterranean Basin.—*Quart. Bull. Hlth Org. L.o.N.* **4** no. 4 pp. 787–808, 4 pp. refs. Geneva, December 1935.

In the third part of this paper (pp. 805–808), the epidemiology of visceral leishmaniasis in the Mediterranean basin is discussed by Edmond Sergent & S. Adler [*cf. R.A.E.*, B **23** 121 ; **21** 218, etc.]. Although the disease is endemic throughout the region, its distribution is uneven, and whereas in Catania, Sicily, there are about 250 cases annually in a population of about 250,000, in Palestine only 5 cases have been recorded during the past 7 years. The number of cases reported is increasing, but it is not known whether this is attributable to the spread of the disease or to a greater knowledge of its diagnosis. Canine visceral leishmaniasis is constantly present in endemic foci, and, wherever sufficient investigations have been made, the disease has been found to be commoner in dogs than in man. It is practically certain that the causal organisms of the disease in man and dogs are identical, for the inoculation of dogs with *Leishmania infantum* isolated from man produces a condition indistinguishable from a natural infection. In Catania the treatment and cure of most of the human cases has had no appreciable effect on the number of new cases occurring annually, and as parasites can only rarely be demonstrated in blood smears, it seems probable that man is not important as a source of infection. In dogs infected macrophages occur in various amounts throughout the entire dermis of the body, whether or not there are visible changes in the skin.

Where the problem has been thoroughly studied, the disease has been found to be associated with sandflies of the group of *Phlebotomus major*, Annan. The infection rate in *P. perniciosus*, Newst., which is apparently the vector in Algeria, Italy, Malta and Marseilles, and in *P. major*, which is the vector in Greece, may be as high as 90 per cent. when they are fed on naturally infected dogs, whereas in *P. perniciosus* fed on man the rate is rarely as high as 5 per cent. Although dead leaves and decaying vegetable matter, which may act as breeding places for larvae of *P. perniciosus*, should be eliminated, the only means of eradicating the disease is by destroying infected dogs.

De Paolis (E.). **La leishmaniosi delle pecore.** [Leishmaniasis of Sheep.]—*Clinica vet.* **58** no. 3 pp. 183–191, 3 pls., 5 refs. Milan, March 1935. [Recd. January 1936.]

The author has found sheep in several flocks in the province of Bari, Italy, to be infected with visceral leishmaniasis. He considers it possible that it was transmitted from sheep to sheep by *Melophagus ovinus*, L., but suggests that the usual vector is *Ixodes ricinus*, L.,

as this tick is common to both sheep and dogs. He observed leishmaniasis in dogs infested with ticks, which they are known to pick up in pastoral districts.

Postiglione (E.). **Il servizio veterinario e le più gravi malattie diffusibili del bestiame nelle nostre Colonie dell'Africa Orientale.** [The Veterinary Service and the most serious transmissible Diseases of Cattle in the Italian Colonies in East Africa.]—*Clinica vet.* **58** no. 8 pp. 614–711, 10 figs., 2 maps, 3 pp. refs. Milan, August 1935. [Recd. January 1936.]

This is a survey of the diseases of domestic animals that occur in Italian East Africa. In Italian Somaliland, *Glossina pallidipes*, Aust., transmits *Trypanosoma brucei* to horses and cattle and *T. congolense* to cattle; *Stomoxys* and Tabanids transmit surra (*T. evansi*) to camels and, less often, to horses and cattle; and all these flies transmit trypanosomes of the group of *T. vivax* to cattle [*cf. R.A.E.*, B **16** 164]. In Eritrea, Tabanids and other blood-sucking flies transmit *T. sudanense* to cattle and trypanosomes of the group of *T. vivax* to camels. Piroplasmosis, which is transmitted by ticks, occurs in horses and cattle in Eritrea, but has not been recorded in Italian Somaliland.

Symes (C. B.). **Outline of Work on** *G. palpalis* **in Kenya.**—*E. Afr. med. J.* **12** no. 9 pp. 263–281, 1 map, 17 refs. Nairobi, December 1935.

After briefly summarising the history of sleeping sickness in Kenya, the author gives an account of the present situation. *Glossina palpalis*, R.-D., occurs along nearly all streams running into Victoria Nyanza and along a large part of the lake shore. Large areas of fertile shore and river land lie derelict; the descendants of the previous owners maintain a miserable existence behind belts of bush infested with tsetse, or papyrus swamps in which mosquitos breed. Although *G. palpalis* is usually closely associated with water, it has been taken up to 400 yards from it; it follows moving objects for long distances, and has been carried on the author's back for more than four miles. It appears to dislike dark dense jungle and prefers to fly along paths made by game or in less dense undergrowth, and it has been found possible to utilise this habit to a certain extent by making paths leading to traps. Hungry females in search of food utilise light shade and travel readily through or along the edge of such crops as maize, the taller millets, cassava and cotton. On occasions they desert shade in order to investigate possible sources of food and thus visit such objects as canoes and greyish stones as much as 70 yards from the shore (possibly owing to their colour resemblance to certain hosts such as crocodile, hippopotamus, etc.). The creation of a small patch of deep shade where only light shade or none previously existed may attract them in large numbers. They exhibit curiosity for anything new, but this subsides as familiarity grows. These characteristics have been exploited in present methods of trapping. They are most active in hot, thundery or stormy weather with bright sunny periods and least so on dull cool days. Experiments with extracts of the glands of cattle as baits [*cf. R.A.E.*, B **21** 114] indicate that those from the sebaceous glands (particularly in the inguinal region) and those from the penis

and testicles are attractive, whereas those from fat are not. Extracts from the interdigital glands of goats appeared to act as deterrents.

Although the general view has been that gravid females alight on objects forming a small angle with the soil to drop their larvae, so that typical breeding areas would be expected to be at the base of rocks and trees and under fallen logs, very few of these have been found in Kenya. Pupae occur almost anywhere in the bush along the lake shore ; a search of 12,000 sq. yds. of river bush revealed 83 living pupae in 57 breeding places, most of which contained only one or two. Although there were 41 decumbent trees or logs of various sizes in the area, in only three cases were puparia found actually below some portion of them and in only one was a pupa living. In old breeding places that had obviously been used for many years, 3,584 empty pupal cases were collected, but in only one were as many as 24 found together. It would therefore appear impracticable to attempt to eradicate this fly by destroying its breeding grounds.

In the block of bush mentioned only 49 examples of *G. brevipalpis*, Newst., were caught in a period of almost a year (as compared with more than 33,000 of *G. palpalis*), but 26 living pupae and 3,846 empty puparia were collected. If the numbers of the latter bear the same relationship to the numbers of adult flies as do those of *G. palpalis*, the population of adults of *G. brevipalpis* must be large. It is active at dusk or during the night, so that, as long as cattle pens are constructed at a distance from infested bush, it should be of no importance in the infection of man or animals with trypanosomiasis, but it should be taken into account in plans for the re-settlement of sleeping-sickness areas. Extensive breeding was found as much as 200–300 yards from water, and many living pupae were taken at an altitude of 200 ft. on a steep hillside about 350 yards from a river. The flies spread during the wet season.

The persistent but low degree of infection with sleeping sickness that occurs is due to the fact that natives are forced to traverse infested bush for wood, water and fish, and the only possible means of controlling the disease is by breaking the contact between man and fly. Clearings 400 yards long and 100 yards wide at the edges of the rivers or lake were found to be too small, and a minimum of 600 yards long by 300 yards wide is now recommended. For a number of reasons wholesale clearing of bush has not been deemed advisable, but it has been found possible to isolate blocks of infested bush by means of clearings too wide for the flies to cross and to rid the block of flies by trapping or catching by hand. Already 5–6 square miles of land on the Kuja River and one of its tributaries in South Kavirondo has been made available for occupation by this means, and it is hoped in the same way to render an area of at least 8 square miles on the lake shore free from fly in two years time. This measure has received the support of the Administration, and steps are being taken to apply it progressively down the Kuja River and its tributaries. It has been shown that with proper organisation heavy river bush can be cleared at a total cost of £2–3 per acre. Traps appear to be most useful in places where fly density is high, but hand collection has to be substituted when the numbers are reduced. This method has not been found uneconomical. An average of seven men a day caught 21,634 flies in 5 months after 14,071 had been taken in traps in 6 months. Four or five trained men with hand nets could probably catch all flies in an isolated mile of average bush in less than two years, even without previous trapping, at a cost of about £100. If

a part of the cost for the two end clearings were included, a mile of river and at least one square mile of fertile land on each side could be rendered fly free for about £250.

MELLOR (J. E. M.). **A Fly developing at a constantly very low Temperature.**—*Ent. mon. Mag.* **71** p. 211. London, 1935.

A batch of 276 pupae of *Calliphora erythrocephala*, Mg., was left for 212 days in a room in which the mean temperature was 41·04°F. and the highest temperature 43·7°F. During this time 106 flies emerged and died, and more than half the remaining puparia contained fully developed flies that had failed to emerge.

FRAENKEL (G.). **Observations and Experiments on the Blow-fly** (*Calliphora erythrocephala*) **during the first Day after Emergence.**—*Proc. zool. Soc. Lond.* 1935 pt. 4 pp. 893–904, 2 figs., 16 refs. London, January 1936.

The digging movements of the freshly emerged adult of *Calliphora erythrocephala*, Mg., while making its way out of the soil, and the process of the inflation of the fly with air and the expansion of the wings are described and analysed. It is shown that the first filling of the air-sacs is due to negative pressure in the body arising from the diffusion of air out of the gut [*cf. R.A.E.*, B **23** 143].

EIDMANN [H.]. **Lebende Fliegenmaden im menschlichen Darmkanal.** [Living Fly Larvae in the human Intestine.]—*Anz. Schädlingsk.* **12** no. 1 pp. 10–11. Berlin, January 1936.

Two instances are recorded in Germany in which living larvae of *Calliphora erythrocephala*, Mg., were passed with human faeces, having apparently been ingested with infested meat.

ROBERTS (F. H. S.). **The Buffalo Louse,** *Haematopinus tuberculatus*, **Nitzsch, on Cattle in Queensland.**—*Qd agric. J.* **44** pt. 5 p. 564, 4 refs. Brisbane, 1st November 1935.

Haematopinus eurysternus, Nitzsch, is the common sucking louse on cattle in Queensland, though *Linognathus vituli*, L., occurs fairly frequently on young animals. *Solenopotes capillatus*, End., has recently been recorded, and in 1933, *Haematopinus tuberculatus*, Burm., the sucking louse of the Indian buffalo, was taken on the tail switch of a bullock in the northern part of the State. The tail switch is the most usual site of infestation by this species, so that the heavy infestations of tail switches, which are not uncommon among cattle in this region, are probably due to it.

CHAGAS (E.). **Summula dos conhecimentos actuaes sobre a Trypanosomiasis americana.** [A Summary of existing Knowledge on American Trypanosomiasis.]—*Mem. Inst. Osw. Cruz* **30** no. 3 pp. 387–416. Rio de Janeiro, December 1935.

This summary of data on American trypanosomiasis (Chagas' disease) includes an account of the evolution of *Trypanosoma* (*Schizotrypanum*) *cruzi* in its Triatomid vectors, which are discussed, and in its mammalian hosts.

DE BEAUREPAIRE ARAGÃO (H.). **Observações sobre os Ixodideos da Republica Argentina.** [Notes on the Ticks of Argentina.]—*Mem. Inst. Osw. Cruz* **30** no. 3 pp. 519–534, 1 pl., 3 pp. refs. Rio de Janeiro, December 1935.

A list is given of the 23 species of ticks known in Argentina, with notes on the hosts, local distribution and synonymy of some of them.

SAVINO (E.). **Peste rural en el Departamento de Leventué, Territorio de La Pampa.** [Rural Plague in the Department of Leventué, Argentina.]—*Rev. Inst. bact. B. Aires* **7** no. 1 pp. 141–150, 8 figs. Buenos Aires, July 1935. [Recd. February 1936.]

In the spring of 1935 an epizootic of plague occurred among rodents, probably *Graomys griseoflavus*, living in tree-holes. Of the fleas found on these rodents 92 per cent. were *Rhopalopsyllus occidentalis*, Almeida Cunha, and 8 per cent. *Craneopsylla wolffhuegeli*, Roths. The fact that only 4 cases of plague in man occurred over a period of 70 days and in a very extensive area is attributed to the fact that this rodent is not closely associated with man nor is it infested with *Xenopsylla cheopis*, Roths.

BONNE (C.). **Over de Crithidien van** *Triatoma rubrofasciatus* **de Geer.**—*Geneesk. Tijdschr. Ned.-Ind.* **75** no. 25 pp. 2098–2100. Batavia, 10th December 1935.

Continuing investigations on the crithidia of *Triatoma rubrofasciata*, DeG., in Java [*R.A.E.*, B **24** 38] the author tested the method of "xenodiagnosis" [**3** 56] and obtained infection in examples of *T. rubrofasciata* that had sucked mouse blood in which direct examination of thick smears did not reveal trypanosomes. In further tests, all bugs fed on healthy mice proved negative while all those fed on infected mice proved positive. Throughout the experiments the bugs used were reared from the egg so as to exclude the possibility of previous infection.

VAN THIEL (P. H.). **Onderzoekingen omtrent den gedrag van** *Anopheles* **ten opzichte van mensch en dier, mede in verband met de rassenstudie bij** *Anopheles maculipennis*. [Investigations concerning the Behaviour of *Anopheles* towards Man and Animals, in Connection with the Study of Races in *A. maculipennis*.]—*Geneesk. Tijdschr. Ned.-Ind.* **75** no. 25 pp. 2101–2118, 2 pls., 17 refs. Batavia, 10th December 1935.

Investigations on the races of *Anopheles maculipennis*, Mg., and on their bearing on the epidemiology of malaria in Holland and Italy are noticed. It is mentioned that the author and other workers regard var. *melanoon*, Hackett, var. *messeae*, Flni., and var. *atroparvus*, van Thiel, in Italy as markedly zoophilous, and var. *labranchiae*, Flni., and *A. sacharovi*, Favr (*elutus*, Edw.) as decidedly anthropophilous, but that experiments at Ardea near Rome [*R.A.E.*, B **22** 34] have led Falleroni to consider all races as inclined to feed on animals. Regarding this contradiction, the author suggests that the number of domestic animals and the type of animal quarters are of primary importance in the incidence of malaria in a given locality.

Similar questions also occur in the Netherlands Indies. *A. sundaicus*, Rdnw. (*ludlowi*, auct.) is generally regarded there as a house mosquito, and is stated by Walch to be exceedingly anthropophilous [**20** 168]. Schüffner, however, found stabled buffalos able to attract it away from man. In the author's opinion the above facts indicate the influence of factors as yet unknown. After stating Roubaud's theory on the maxillary index [**16** 210, etc.] and its development in recent years [**21** 140 ; *cf.* also **24** 47], he gives an account of an investigation, not yet concluded, on the value of the maxillary index in the Netherlands Indies, based on examination of mosquitos from both houses and stables. He used an oil immersion lens when counting the teeth, obtaining numbers higher than by Roubaud's method, but uniformly so for all species. The maxillary index graph given by Roubaud, Toumanoff & Gaschen [**21** 140] for Indo-China is compared with one for the indices found by the author. In Roubaud's graph the curves for *A. hyrcanus* var. *sinensis*, Wied., and *A. vagus*, Dön. (both harmless species) are distinct from those for *A. aconitus*, Dön., *A. minimus*, Theo., *A. maculatus*, Theo., and *A. jeyporiensis*, James (all four dangerous vectors of malaria), but in the author's graph the *hyrcanus* curve, being that of var. *nigerrimus*, Giles, is merged among the others. A table shows the species arranged according to maxillary index, giving the figures as obtained by the author and also reduced to correspond to Roubaud's method of examination. *A. karwari*, James, *A. annularis*, Wulp (*fuliginosus*, Giles), *A. tessellatus*, Theo, *A. maculatus*, *A. aconitus*, and *A. kochi*, Dön., are paucidentate (reduced index about 11·5), while *A. hyrcanus* var. *nigerrimus*, *A. subpictus*, Grassi, and *A. vagus* are multidentate (reduced index above 13). An intermediate position is occupied by *A. barbirostris*, Wulp (near the paucidentate group) and *A. sundaicus* (near the multidentate). An entirely different order occurs if the species are arranged according to the percentage engorged with human blood in dwellings in districts with a normal abundance of domestic animals, and this arrangement agrees well with their real importance as vectors of malaria in the Netherlands Indies. The percentages are : *A. sundaicus* 86, *A. hyrcanus* var. *nigerrimus* 83, *A. aconitus* 12, *A. subpictus* 12, *A. maculatus* 9, *A. barbirostris* 9, *A. annularis* 9, *A. kochi* 4, *A. vagus* 1, and *A. tessellatus* 0.

Four facts adverse to the maxillary index theory were observed : *A. sundaicus*, definitely the most anthropophilous species in the Netherlands Indies, must be, according to Roubaud, closest to the multidentate group, and in the index table it is near to the closely related but very much less dangerous *A. subpictus*, which is definitely multidentate. *A. hyrcanus* var. *nigerrimus*, which is almost as anthropophilous as *A. sundaicus* though generally less dangerous, belongs to the multidentate species. The few individuals available of *A. punctulatus*, Dön., had 19 teeth, a number higher than in any other species, yet Walch regards *A. punctulatus* as the most dangerous vector in the eastern part of the archipelago [**20** 168] and as highly anthropophilous ; the individuals examined by the author were taken in an area having a moderate number of domestic animals. On the other hand, *A. tessellatus*, recorded by Walch as the least anthropophilous species, is markedly paucidentate and hence, according to Roubaud, most dangerous. In Cochin China, Toumanoff found that *A. tessellatus*, with an average index of only 11·7, was feeding chiefly on buffalos [**23** 81]. Opposed to these four points, there is only the fact that in the Netherlands Indies *A. vagus* belongs to the most multidentate and least anthropophilous

species, and it is concluded that the maxillary index is an unreliable guide in that region. The nature of the blood meal should be investigated, attention being paid to the abundance of animals and the type of animal quarters.

Even this is unlikely to elucidate fully the food preferences, because of lack of knowledge why one species prefers to feed on man and another on an animal. The author and Reuter made experiments with the acids found in sweat. None appeared to be preferred by *Aëdes aegypti*, L., the mosquito used, but warmth, especially moist heat, appeared attractive. Subsequent work with starving females of *Anopheles maculipennis* var. *atroparvus* gave similar results. These and other experiments with pigs indicate that warmth and moisture are the chief factors attractive to *atroparvus* and what is called its zoophily is very probably due to their presence in pigsties.

SHORTT (H. E.) & D'SILVA (H. A. H.). **The Distribution of Indian Tick Typhus with Notes on Laboratory Findings.**—*Indian med. Gaz.* **71** no. 1 pp. 13–21, 6 charts, 1 map, 32 refs. Calcutta, January 1936.

A list is given of the 177 cases recorded from India as fevers of the typhus group [*cf. R.A.E.*, B **24** 46], showing the locality in which the disease was contracted, its approximate altitude and the time of year when the infection took place. There is a general tendency for cases to occur in the summer at the higher elevations (4,500 to 6,000 ft.) and in the winter in the plains, that is to say, they occur at times when the temperature is moderate. Thus in any search for the vector or vectors, climatic requirements should be taken into consideration. There is a definite history of tick bite in 16 of the cases, but not in any of those from the Simla Hills. The results of inoculating blood from four cases from the Simla Hills into laboratory animals are given. In serological tests grey palm squirrels (*Sciurus palmaris*), which are reported to have been recently introduced into the Kasauli area, reacted in 36 instances out of 65 to the strain of proteus (O suspension of proteus XK) to which all but one of the local cases of typhus-like fever had reacted, whereas only 12 out of 62 squirrels from the plains reacted. Examination of the ectoparasites of these two batches of squirrels showed that those from the hills harboured fleas (*Ceratophyllus simla*, J. & R.) almost exclusively, whereas those from the plains harboured lice (*Haematopinus* sp.). A few ticks were found in each series, but were lost before they could be identified. One of the authors, who was in the habit of taking evening walks in the hills around Kasauli in the course of the last two or three seasons when cases of typhus were comparatively numerous in the district, remained uninfected even though he found ticks crawling on him, or actually attached, almost daily. These ticks were chiefly parasites of the goral [a Himalayan antelope]. It seems probable that he had been more exposed to a vector from the jungle than those persons who had contracted the disease, a fact implying that the vector was probably inside the cantonments.

DYSON (J. E. B.) & LLOYD (L.). **The Distribution of the Early Stages of** *Metriocnemus longitarsus*, **Goet. (Chironomidae) in Sewage Bacteria Beds.**—*Proc. Leeds phil. Soc.* **3** no. 3 pp. 174–176, 3 refs. Leeds, January 1936.

Investigations carried out in sewage beds at Leeds [*cf. R.A.E.*, B **23** 238] to determine the distribution of larvae and pupae of *Metriocnemus*

longitarsus, Goet., showed that pupae were relatively numerous 2 ins. below the surface but scarce lower down, whereas the feeding larvae were abundant at depths of 3–6 ft. It is concluded that the larvae approaching maturity climb and pupate near the surface to the advantage of the emerging flies. The eggs, laid just below the surface stones [*cf.* **22** 180] hatch in 2–3 days at about 18°C. [64·4°F.], the larvae become full-grown in a month and the pupal stage lasts 2–4 days.

Lloyd (L.) & Turner (J. N.). **The Migrations of the Larvae of** *Metriocnemus longitarsus*, **Goet. (Chironomidae) in response to Gravity and Light.**—*Proc. Leeds phil. Soc.* **3** no. 3 pp. 177–188, 7 refs. Leeds, January 1936.

It was found in the laboratory that 2nd and 3rd instar larvae of *Metriocnemus longitarsus*, Goet., climbed upward [*cf.* preceding paper] and also showed strong movement to light. For these experiments the authors used flies trapped on the sewage beds at Leeds, fertile eggs being readily obtained in December–July. Larvae were exposed to varying oxygen concentrations, various temperatures and various depths of water, both in the absence and in the presence of different foods. The tropisms still remained whatever conditions were set up, a shortage of oxygen intensifying them ; both movements would tend to bring the larvae in contact with living algae, their preferred food. No external factor beyond the mere fact of submergence seemed responsible. Near the onset of pupation the larvae showed the responses in an enhanced form in well oxygenated water, so that they mostly left the water to pupate. In bacteria beds the final tendency to climb must have its origin in physiological change, since in the beds even the stimulus of submergence is lacking.

Briercliffe (R.). **The Ceylon Malaria Epidemic, 1934–35. Report by the Director of Medical and Sanitary Services.**—*Ceylon : Sess. Paper XXII–1935*, 96 pp., 5 pls. Colombo, September 1935. Price *Rs.*4·50. [Recd. March 1936.]

This detailed report is divided into five main sections, dealing respectively with malaria in Ceylon in general [*cf. R.A.E.*, B **16** 29], the epidemic of 1934–35 (up till the end of April 1935) [*cf.* **23** 251], the clinical information obtained, the medical organisation, and data on previous epidemics. The first section includes a concise account of the geographical and seasonal distribution, breeding places and habits of *Anopheles culicifacies*, Giles, the most important vector [*cf.* **23** 61]. In the course of the second section, the abnormal rainfall conditions and their effect on the breeding and prevalence of *A. culicifacies* are described, and data are given on natural infection rates in the mosquito. A part of the fourth section deals briefly with the anti-larval measures that were carried out on rivers, in villages and in Colombo.

The following information of entomological interest is taken from the author's summary : The epidemic, which began in October 1934 and affected the south-west quadrant or wet zone of Ceylon, was of greater magnitude than any previously recorded. The failure of the rains of the south-west monsoon from April to September and of those of the north-west monsoon from November to March led to the drying up of rivers in the wet zone and consequently to the formation of suitable breeding places for *A. culicifacies*, which occurred in these situations

more frequently and in greater numbers than in previous years. In normal years it is found principally in the dry zones and occurs in the wet zone only in small numbers, since conditions there are usually unfavourable for its development. It also bred in wells, borrow pits and quarries but these were not of major importance. Larvae were found in largest numbers in river areas where the epidemic was most intense. High infection rates were obtained among adults caught in dwellings in the epidemic area, the mean rates for the whole area for Decembeı, January, February and April being 12·9, 3·1, 1·9 and 3·4 per cent. respectively.

GILL (C. A.). **Report on the Malaria Epidemic in Ceylon in 1934–35 together with a Scheme for the Control of Malaria in the Island.**—*Ceylon*: *Sess. Paper XXIII–1935*, 44 pp., 6 pls., 9 maps, 7 charts. Colombo, September 1935. Price *Rs*.3. [Recd. March 1936.]

The author was sent to Ceylon to investigate the circumstances responsible for the severe epidemic of malaria that occurred in 1934–35 and to formulate an anti-malaria policy based on the liability of the Island to suffer from epidemics of such magnitude and intensity. The results of his work are embodied in the present report. In the first part an account is given of an intensive study of the epidemic and in the second part the details of a scheme for the control of the disease.

The same mosquito, *Anopheles culicifacies*, Giles, with the same habits is responsible for malaria epidemics in both northern India and Ceylon, and in both places the rivers react in the same way to rainfall, but in northern India and the dry zone of Ceylon abnormal breeding is associated with excessive rainfall and in the wet zone of Ceylon with drought. The main epidemic was confined to the catchment area of three or four rivers in the wet zone, although in Ceylon rivers radiate in all directions from the central montane tract to the sea, and the vector is present in all parts of the Island. The distribution of the epidemic in time and space does not suggest that the primary cause of the outbreak was associated with these rivers and their tributaries. Finally, droughts occur in the wet zone at rare and irregular intervals, whereas it has been shown that malaria epidemics of varying degrees of intensity occur with great regularity at intervals of about five years. It thus appears that although the effect of drought on the rivers in the wet zone may have played an important part in determining the intensity of the disease, the view that the outbreak was caused solely by the abnormally prolific breeding of *A. culicifacies* does not appear adequately to explain all the associated phenomena.

It is suggested that periodicity plays a more important part than has hitherto been recognised in the causation of malaria outbreaks. In Ceylon and many other countries, it has been found that epidemics tend to recur at intervals of approximately 5–6 years or multiples thereof. Little is known of the nature and significance of this type of periodicity, but it is presumably a quality pertaining to the malaria parasite. The predominant attribute of periodicity is the amplitude of its range, and it is perhaps significant that, whereas epidemics are normally preceded by one or two years of abnormal salubrity, the Ceylon epidemic was preceded by four such years in the wet zone, and, other factors being favourable, the epidemic might therefore have been expected to be proportionately severe. Periodicity alone does not explain why the whole Island was not affected. Further explanations

must therefore be found for the variations in distribution and intensity. Owing to the four years of exceptional salubrity, the proportion of children under five years of age (who are the chief victims of malaria epidemics) was abnormally high in the wet zone, and, as a result of the unusual freedom from malaria, the communal immunity was lower than it had been in any previous quinquennium. The spleen rate was 0–20 per cent. In these circumstances the drought, which not only occasioned economic stress but led to the prolific breeding of the vector, prepared the way for an outbreak of exceptional magnitude and intensity during the ensuing malaria season. In the dry zone, largely owing to malaria, the number of children under 5 years was relatively low, and the spleen rate was high (40–50 per cent. or more), from which it follows that the communal immunity at the beginning of the epidemic was proportionately great. Thus in spite of the " influence " causing periodicity, the intensity of the epidemic (as measured by mortality) was relatively low. To the south and west of the main area, the epidemic was extremely mild ; the predisposing factors were similar except that the spleen rate was about 0–5 per cent., and the vector, although present, was not widely prevalent.

With regard to the association of epidemics in the wet zone with drought and in the dry zone with excessive rainfall, the author suggests that abnormal conditions, such as abnormal meteorological conditions, might influence cyclical periodicity, and thus favour the occurrence of an epidemic. In the wet zone, drought constitutes an abnormal condition, and might, therefore, be conducive to the outbreak of an epidemic, particularly if it occurred at a time when an epidemic was due on the basis of the five-year cycle. On the other hand, in the dry zone, excessive rainfall is abnormal and might therefore be the determining factor in the causation of an epidemic, although on account of the relatively high communal immunity and the small infant population, the intensity (as measured by mortality) might be relatively low.

In the wet zone an epidemic comprises two or more waves with their maxima (as measured by mortality) in June and January, whereas in the dry zone there is only one wave with its maximum in January. The author suggests that again periodicity (in this case the seasonal periodicity of the malarial parasite) plays an important part. It is not merely a question of the species of parasite, for *Plasmodium vivax* is reported to be present throughout the Island and in most places is the predominant species.

It is believed that no major epidemic is likely to occur for at least five years, however favourable meteorological and entomological conditions may be.

Although there is no hope of eradicating malaria from Ceylon at an early date, the author considers that a progressive decline in the amount of sickness and mortality due either directly or indirectly to the disease may be achieved within a reasonable period. He points out that, in a scheme embracing the whole Island, all possible methods must necessarily be employed, although the use made of any individual measure may be varied according to local conditions.

Anti-mosquito measures may be limited to the control of *A. culicifacies*, which is ubiquitous. There appears to be no need, however, to apply measures in the montane tract at elevations above about 3,500 feet, and little need in those parts of the Island where endemic malaria (as measured by the spleen rate) is almost completely absent and where

epidemics are unlikely to occur. Moreover, it is not always necessary to consider all types of water collections, and rice-fields may often be safely ignored. Finally, in the northern half of the Island and in its south-east quadrant, the hamlets are so scattered that anti-mosquito measures could not be economically applied. Thus measures should be restricted mainly to breeding places in and near towns and large villages throughout the Island, particularly in the populous areas of the south-centre, west and south-west. Wherever possible anti-larval measures should aim at the permanent eradication of breeding places by measures that should include the training of rivers and the provision of storm water drains. In certain areas and in a certain type of house screening and the use of mosquito nets is advocated. In the absence of a recent epidemic, spleen rate is usually correlated with the economic status of a community, and in places where hyper-endemic malaria is associated with economic stress, treatment by drugs is usually of little avail and the value of anti-mosquito measures may, under certain circumstances, be greatly reduced. Thus all anti-malaria work in economically depressed areas must be accompanied by measures designed to alleviate stress and improve hygienic conditions.

It is pointed out that the three districts in the south that escaped or were only slightly involved in the epidemic differed from the epidemic area in only two respects, *viz.*, the spleen rate was of the order of 1 per cent. and the numbers of the vector were relatively and absolutely low. It would thus appear that if the spleen rate and the Anopheline rate in the main epidemic area could be reduced to the levels existing in these districts, no epidemic of appreciable magnitude could recur, however favourable meteorological and other conditions might be.

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Williams (C. L.) & Dreessen (W. C.). **Un liquide à base de pyrèthre non inflammable pour pulvérisations à bord des aéroplanes.**—*Bull. Off. int. Hyg. publ.* **27** no. 12 pp. 2371–2376, 1 ref. Paris, December 1935. [Translation : see *R.A.E.*, B **24** 33.]

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Lutz (A.) & de Oliveira Castro (G. M.). **Sobre algumas novas especies de motucas do genero *Esenbeckia* Rondani.** [On some new Tabanids of the Genus *Esenbeckia*.]—*Mem. Inst. Osw. Cruz* **30** no. 3 pp. 543–562, 13 refs. Rio de Janeiro, December 1935.

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Goetghebuer (M.). **Ceratopogonidae** [including 2 new species] **et Chironomidae récoltés pour la première fois en Belgique.**—*Bull. Ann. Soc. ent. Belg.* **75** pt 11–12 pp. 413–418, 3 figs. Brussels, 31st December 1935.

De Meillon (B.) & Osburn (H. S.). **A Case of Intestinal Myiasis** [in South Africa] **caused by the Larvae of *Chrysomyia chloropyga*, Wied. (Diptera, Calliphorinae).**—*S. Afr. med. J.* **9** pp. 654–655, 3 refs. Cape Town, 28th September 1935.

Werneck (F. L.). **Nota prévia sobre uma nova especie de *Microthoracius* (Anoplura-Haematopinidae).** [*Microthoracius minor* sp. n., on alpaca (*Lama pacos*) in Argentina.]—*Rev. med.-cirurg. Brasil* **43** no. 4 p. 112. Rio de Janeiro, April 1935. [Recd. January 1936.]

Kishida (K.). **Notes on the Acarina-mites and Ticks** [including *Amblyomma yajimai*, sp. n., on water buffalo] **from the Island of Formosa, collected in August 1935.**—*Lansania* **7** no. 69 pp. 129–144, 1 fig. Tokyo, October 1935.

Field (H. M.). **A new locality** [Wisconsin] **for the Black Widow Spider** [*Latrodectus mactans*, F.].—*Science* **83** no. 2147 p. 186, 2 refs. New York, 21st February 1936.

LARSON (C. L.), SHILLINGER (J. E.) & GREEN (R. G.). **Transmission of Rabbit Papillomatosis by the Rabbit Tick,** *Haemaphysalis leporis-palustris.—Proc. Soc. exp. Biol. Med.* **33** no. 4 pp. 536–538, 7 refs. New York, January 1936.

The authors obtained transmission of rabbit papillomatosis in Minnesota by nymphs of *Haemaphysalis leporis-palustris*, Pack. Two hundred of the nymphs were fed in a muslin bag over the ear of an infected cottontail rabbit. After 24 hours, 50 were removed from the base of a papilloma on the ear and allowed to feed for 5 days on the ear of another cottontail rabbit. After 16 days, 2 small horns were seen at the site of the infestation, and after a further 3 days 5 more tumours appeared. Growth continued, and a typical infection of papillomatosis as it occurs in wild rabbits developed. It is thought probable that the infection may also be transferred by blood-sucking Diptera.

BUXTON (P. A.). **Studies on Populations of Headlice** (*Pediculus humanus capitis* : **Anoplura**). **I.**—*Parasitology* **28** no. 1 pp. 92–97, 3 refs. Cambridge, 27th January 1936.

The studies described (which are being continued) were undertaken with a view to determining the percentage of people infested with *Pediculus humanus capitis*, DeG., at different times and places, the number of lice on different people and the proportion of males, females and young in the louse population. In order to obtain as accurate a sampling as possible, a method was developed and standardised in which counts are made of the actual numbers of head lice in crops of hair from individuals. The hair from the head of each individual, taken by shaving if possible, is weighed and transferred to a beaker containing a sulphide solution (½ lb. potassium hydroxide and 1 lb. sodium sulphide in 1 gal. water [*cf. R.A.E.*, B **22** 165]) set in a bath of boiling water. Five pints of the solution is sufficient to dissolve 6 oz. hair, the hair of a European man weighing about 30 gm. [1 oz.]. The hair dissolves completely in 2–3 hours, forming a black solution in which the lice cannot be seen. The lice (including newly-hatched ones) are then removed by passing the solution through a funnel of stainless steel gauze of 60 meshes to the linear inch. Any material that is not dissolved and is retained in the gauze funnel is washed back into a dish and the lice searched for and counted. With a mechanical counter in the left hand and a pipette in the right, it is easy to count the males, females and young separately. As methods of collection vary, the figures from different countries are not strictly comparable, but care has been taken to see that no selection of clean or infested samples is made, and so far as possible the details of collecting are standardised and adhered to in each country. It is essential that work should be carried on throughout the year; about 30 samples a month are at present thought to be sufficient.

Specimens obtained from 235 recruits at the Woolwich Depot of the R.A.M.C., during the year ending April 1935 revealed no lice. The heads were not shaved, but the results indicate that if infestations occur, they are rare and light.

Specimens from Lagos, Nigeria, were obtained from the African subjects of post-mortem examinations made between February 1934 and February 1935, by shaving the hair from the whole scalp. Of the 102 samples, 21 harboured lice, the numbers varying from 1 to 1,286.

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Women were more frequently and more heavily infested than men, the difference being statistically significant. The explanation is probably the elaborate and rather permanent head-dressing, but possibly the longer hair (the average weights being 6–7 gm. for a man and 24 gm. for a woman). The author has not, however, been able to establish any statistical relation between the weight of a crop of hair and its infestation. There was no evidence of any seasonal distribution in infestation in Lagos.

Tate (P.) & Vincent (M.). **The Biology of Autogenous and Anautogenous Races of** *Culex pipiens* **L. (Diptera : Culicidae).**—*Parasitology* **28** no. 1 pp. 115–145, 5 graphs, 3 pp. refs. Cambridge, 27th January 1936.

In this paper are given the main results of a comparative study that has been carried out in the laboratory during the past three years of three autogenous strains of *Culex pipiens*, L., from Hungary, Greece and Malta, and several hibernating, anautogenous strains from England.

The following is taken from the authors' summary : Further experiments confirmed preliminary ones [*R.A.E.*, B **20** 230] in showing that prolonged illumination has an activating influence on females of the anautogenous race, both hibernating and laboratory bred, and greatly stimulates engorgement. With the aid of artificial light during the winter, the anautogenous race has been kept breeding in the laboratory throughout the year for 11 generations without the occurrence of cyclical hibernation (asthenobiosis). Consequently it is suggested that the length of daylight may be of importance in controlling the natural hibernation of females of this race. Females of the English anautogenous race, whether of hibernating or of active generations, laid normally after one blood meal and did not exhibit gonotrophic dissociation. They also oviposited readily after being artificially fed on bird blood. Unfed females lived for a maximum of 19 days and never accumulated fat-body autotrophically. If fed on apple for 5 weeks, females accumulated sufficient reserves to enable a small percentage to survive 15 weeks of starvation. In the anautogenous race pairing always begins in the air although it may be completed on the ground. The females do not lay without a blood meal ; they show little tendency to bite man but bite birds voraciously.

The autogenous strains were obtained from rural areas and have been maintained in the laboratory for over three years. Continuous breeding under autogenous conditions (with no blood meals) for several years and through 45–49 generations has had no deleterious effect on them. Spanogyny, or the gradual decrease in the numbers of females produced in succeeding generations, does not necessarily follow prolonged autogeny if the cultures are kept under favourable conditions [*cf.* **21** 267]. Males of the autogenous race pair with resting females, so that pairing can take place in very small areas. Cross-mating was easily obtained between the two races, autogenous males with anautogenous females and *vice-versa*. Stenogamy and eurygamy [*cf.* **20** 213] are hereditary characters. Stenogamy always appears in the F_1 generation, but autogeny sometimes appears in the F_1 and sometimes not until the F_2 generation. Eggs are quickly killed by temperatures below freezing point ; and young larvae die within 24 hours at 0°C. [32°F.]. Adults, even hibernating females, die within 4 days at −16°C. [3·2°F.].

Mathis (C.). **Elevage d'*Anopheles gambiae* à Paris.**—*C. R. Soc. Biol.* **121** no. 1 pp. 21–22, 1 ref. Paris, 1936.

Adults of *Anopheles gambiae*, Giles, obtained in Dakar on 12th June were transported to Paris, and between 19th July and 30th December 6 generations were reared from them. A large number of eggs was obtained in each generation, but the rearing of the larvae was difficult. At Dakar [*cf. R.A.E.*, B **23** 253], the rearing jars were kept on tables in the laboratory, where, owing to the strong light and the temperature of the surrounding atmosphere, there was an abundant growth of plankton (consisting chiefly of unicellular green algae), which ensured the purity of the water. In Paris, when the temperature fell, it was necessary to keep the jars in an incubator and consequently in the dark, so that conditions were unfavourable for the liberation of oxygen by the algae. It was necessary to aerate the breeding jars artificially by means of small pumps. The larvae were fed on unicellular green algae (*Chlamydomonas*, *Chlorella vulgaris* and *Pleurococcus*). The adults were kept in cages of brass wire gauze (covered with damp cloths to maintain the required degree of humidity), which were placed at night in an incubator at about 24°C. [75·2°F.] and in the day in a heated room in the light. Females were fed on man or guineapig. Pairing took place in a confined space, and oviposition only occurred after several blood meals [*loc. cit.*].

Gater (B. A. R.). **Aids to the Identification of Anopheline Imagines in Malaya.**—Med. 8vo, 242 pp., 9 pls., 236 figs. Singapore, Govt S.S. & Malar. adv. Bd F.M.S., 1935. Price $1.

In this booklet on the adult Anophelines of the Malay Peninsula, Siam, Borneo, Java and Sumatra, the sections supplementing the keys are similar to those in the booklet on the larvae [*R.A.E.*, B **22** 177]. The only additional section is one giving information on the examination of living and dead examples, the maintenance of living examples, and dissection. The present edition must be regarded as a preliminary one, since a revision of the Anophelines of Malaya is in progress, and it is hoped that the results may be incorporated in a revised edition of the two booklets.

Malmgren (B.). **Réapparition de la tularémie en Suède au cours de l'année 1934.**—*Bull. Off. int. Hyg. publ.* **27** no. 11 pp. 2184–2191, 1 pl., 1 map, 2 refs. Paris, November 1935.

In the course of this paper on an outbreak of tularaemia in man in Sweden during 1934, the question of the vector is briefly discussed. In a large number of the cases the bite of some kind of insect was stated to have preceded the onset of the disease, but examination of a certain number of ticks and of insects, such as *Culex pipiens*, L., *Simulium* (*Melusina*) *reptans*, L., and *Musca domestica*, L., for the presence of *Bacterium tularense* gave negative results. It is considered that ticks, of which the most important in Sweden is *Ixodes ricinus*, L., are unlikely to be concerned in transmission.

Parrot (L.). **Les espèces algériennes du genre** *Phlebotomus* **(Psychodidae).**—*Bull. Soc. Hist. nat. Afr. N.* **26** *bis* pp. 145–149, 31 refs. Algiers, December 1935.

A brief account is given of the habits of the sandflies of the genus *Phlebotomus* in Algeria, with notes on the distribution of the individual species, of which *P. papatasii*, Scop., and *P. sergenti*, Parr., are most often found in houses.

Bück (G.). **Les tiques à Madagascar et les maladies qu'elles inoculent aux animaux domestiques de la Grande Ile.**—*Rev. agric. Maurice* no. 84 pp. 196–209, 6 pls., 1 ref. Mauritius, 1935.

The only Argasid ticks found in Madagascar are *Argas persicus*, Oken, and *Ornithodorus moubata*, Murr., neither of which appears to be of importance in the transmission of diseases of domestic animals. On the other hand there are about ten species of Ixodids, including *Amblyomma variegatum*, F., *Boophilus annulatus decoloratus*, Koch, *B. annulatus*, Say, and *Rhipicephalus sanguineus*, Latr. The first two are the most abundant and the most important as vectors of disease, and a brief account is given of their morphology and bionomics. The diseases transmitted by ticks and methods of treating them are discussed. Bovine piroplasmosis, caused by *Piroplasma bigeminum*, is transmitted by *B. annulatus decoloratus* ; it occurs on the high plateaux, usually in the second half of October and in November, at least two weeks after the hatching of the ticks. Bovine anaplasmosis, caused by *Anaplasma marginale*, is transmitted by the same tick ; it usually occurs during the hot season, although relapses take place in the cold weather on the high plateaux. Piroplasmosis of sheep, caused by *Piroplasma* (*Babesiella*) *ovis*, has only recently been recorded in Madagascar ; in Europe it is transmitted by *Rhipicephalus bursa*, C. & F., but the infected sheep was harbouring *B. annulatus decoloratus*. Equine piroplasmosis, caused by *Piroplasma caballi*, has been observed but is rare. Canine piroplasmosis, caused by *Piroplasma canis* and transmitted by *Rhipicephalus sanguineus*, is even more rare. Heartwater, a disease of sheep, goats and cattle caused by *Rickettsia ruminantium* and transmitted by *A. variegatum*, is present practically throughout Madagascar, but particularly in the south ; it is less frequent in indigenous sheep than in improved strains. Ulcerous lymphangitis in horses is due to the Preisz-Nocard bacillus, a saprophyte found in soil, manure and the intestines of animals, which may be introduced into the animal through any cutaneous lesion. Ticks, particularly *A. variegatum*, have been shown to play an important part in the transmission of the infection, which is distributed throughout the Island and is one of the obstacles preventing the successful rearing of horses.

The measures recommended for the control of ticks are bush fires, dipping and rotation of pastures. Burning should be carried out at the beginning of the hot season, when the ticks hatch in their largest numbers. This method does not, however, affect ticks on their hosts or eggs buried in the soil. Sodium arsenite dips give the most satisfactory results, but unfortunately the number of dipping tanks in the Island is small. *B. annulatus decoloratus*, which spends 3–4 weeks on its host and 8 months off it, should theoretically be controlled in 8 months by dipping at intervals of 3 weeks, provided that ticks are removed from the ears (which are not reached by the dip) and that

the animals are kept in an enclosed pasture from which infested animals are excluded. In the case of *A. variegatum*, which remains 4–5 days on its first two hosts (in its larval and nymphal stages) and about 12 days on its third host (in the adult stage), dipping should be carried out every 4 days, and as the period off its hosts is longer than in the case of *B. annulatus decoloratus*, the dippings must be continued for a longer period. In Madagascar dipping is most usually carried out at intervals of 7 days with dilutions of 1 : 200 or 1 : 250, and satisfactory results are obtained. Under normal conditions, once a tank of dip is prepared, it will last for more than a year ; it is renewed when it is dirty or when it has undergone chemical change, such as oxidation, which produces arsenate toxic to cattle ; a dip that is regularly used for cattle does not undergo such oxidation. The rotation of pastures necessitates enclosed fields and cannot be widely adopted in Madagascar.

SCHWARDT (H. H.). **Southern Buffalo Gnat. Autumn Horse-fly.**—*Bull. Arkansas agric. Exp. Sta.* no. 323 (47th Rep.) p. 34. Fayetteville, Ark., December 1935.

Observations made during 1932–35 have shown that *Simulium* (*Eusimulium*) *pecuarum*, Riley, breeds principally in the large rivers and probably in most of the larger streams in Arkansas. It is highly improbable that it develops in standing water, such as roadside ditches and overflow puddles [*cf. R.A.E.*, B **23** 297]. Cold mixed lubricating oil emulsion is a cheap and effective repellent [**24** 3].

Tabanus sulcifrons, Macq. (autumn horse-fly) is a pest during late summer and early autumn, the greatest emergence in Arkansas usually occurring during the last two weeks of August and the first two in September. Its life-cycle occupies a year. Eggs have been found on the undersides of elm twigs six feet from the ground. The larvae do not apparently require mud as a habitat, and both eggs and full-grown larvae have been found well removed from water. Larvae hatching in late summer have invariably pupated in August or September of the following year. The artificial maintenance of summer temperatures enabling the larvae to feed and grow during the winter does not hasten pupation ; the larvae become full-grown in a shorter period, but do not pupate until the normal time. The species is more persistent during very dry seasons, such as 1934 and 1935, than other common Tabanids.

LAAKE (E. W.), CUSHING (E. C.) & PARISH (H. E.). **Biology of the Primary Screw Worm Fly,** *Cochliomyia americana*, **and a comparison of its Stages with those of** *C. macellaria*.—*Tech. Bull. U.S. Dep. Agric.* no. 500, 24 pp., 1 col. pl., 14 figs. Washington, D.C., January 1936.

Until recently *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.) was confused with *C. macellaria*, F. [*cf. R.A.E.*, B **22** 45 ; **23** 11] and the species to which previous information referred is doubtful. Studies of *C. hominivorax* were therefore undertaken by the U.S. Bureau of Entomology and Plant Quarantine, and the results are given in the present bulletin. Its economic importance, distribution and seasonal activity are briefly discussed, and the morphology and bionomics of all stages are described and compared with those of *C. macellaria*. The

characters distinguishing the different larval instars of the two species are summarised. Data on the bionomics do not differ to any great extent from those already noticed [*cf.* **23** 200; **24** 4].

The following is taken from the authors' summary: *C. hominivorax* appears to be a primary, obligatory parasite that initiates most of the screw-worm infestations in warm-blooded animals in tropical and subtropical America. Its distribution extends from Argentina to the southern part of the United States [*cf.* **23** 200, 220; **24** 5, 6], although it has been found in a few instances further north [*cf.* **24** 9]. Individual females may lay as many as 2,853 eggs. The larvae appear to penetrate more deeply into the soil to pupate than do those of *C. macellaria*. Laboratory experiments on the effects of cold on various stages showed that the eggs were killed at temperatures near freezing point, but that prepupae, pupae and adults can withstand temperatures considerably below this point. Evidence indicates that in nature *C. hominivorax* breeds only in living animals, but in the laboratory it has been reared from egg to adult on dead tissue. The comparative abundance of *C. hominivorax* and *C. macellaria* in nature as determined by the numbers attracted to fresh and necrotic wounds is 1 of the former to 590 of the latter, but as determined by the numbers taken in meat-baited traps it is 1 to 2,427. Under controlled laboratory conditions the length of the life-cycle of *C. hominivorax* is about twice that of *C. macellaria*.

STRONG (L. A.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, 1935.**—96 pp. Washington, D.C., U.S. Dep. Agric., 1935.

Much of the information contained in the section of this report dealing with work carried out during 1934–35 on insects affecting man and animals in the United States has already been noticed [*cf. R.A.E.*, B **23** 297; **24** 33, 61, etc.]. A preliminary study of the habits of the stable fly [*Stomoxys calcitrans*, L.] on the coast of Florida showed that prolific breeding takes place in piles of decomposing *Sargassum*, a brown marine alga. Help in the control of *Aëdes aegypti*, L., was given in several towns and cities in Florida where an outbreak of dengue occurred. In addition to allantoin [*cf.* **23** 305], blowfly maggots excrete another substance, not yet identified, which, in laboratory tests, killed certain pathogenic bacteria in 5–15 minutes without injuring human tissues.

MAURICE (A.). **La** *Lucilia sericata* **en thérapeutique.**—*Ann. Parasit. hum. comp.* **14** no. 1 pp. 35–47, 1 pl., 32 refs. Paris, 1st January 1936.

Accounts are given of a number of cases in which a variety of lesions in man were successfully treated by the application of living larvae of *Lucilia sericata*, L., or of extracts from them. A case of the successful treatment of wounds in a horse has already been noticed [*R.A.E.*, B **23** 171].

[SYMES (C. B.) & ROBERTS (J. I.).] **Section of Entomology.**—*Rep. med. Res. Lab. Kenya 1934* pp. 20–25. Nairobi, 1935.

Brief notes are given on the work carried out in connection with the control of malaria and sleeping sickness in various localities in Kenya

during 1934. At Kisumu, reclamation of the lake shore has been continued; the progress made shows that, although the task is heavy, it is not impossible, and the aesthetic value of the work, together with the abolition of many acres of breeding grounds of *Anopheles funestus*, Giles, more than justifies the effort. The clearing of lake-side vegetation will be extended until the airport area is protected. *A. funestus* breeds in a swampy area, too extensive to be controlled, about a mile from the edge of the town, but the clearing of intervening bush has effected a striking reduction in the numbers occurring in the adjacent residential area. In the Meru district *A. marshalli*, Theo., occurs as a domestic mosquito. The excellent clearing work that is being carried out against *Glossina* on parts of the lake shore in Central Kavirondo is providing large areas of fertile agricultural lands for development. In one of these reclaimed areas a jetty has been built from which the local cotton crop has already been exported and which is also proving of great value to those engaged in gold mining in the district. The discovery of *G. swynnertoni*, Aust., among specimens collected in the south-west Masai district [*cf. R.A.E.*, B **23** 77] explains the case of sleeping sickness contracted in that district during 1933.

Satisfactory results have been obtained in the fumigation of steamers and trains with "Celophite Units," which consist of paper discs impregnated with liquid hydrocyanic acid gas, and their use is recommended in place of the old types consisting of clays impregnated with HCN. In the hotter parts of the country, when tins of the old types were opened, the contents were liable to blow out and damage materials. If the Celophite blows out, no damage is likely to occur, it is cheaper to use, and fumigation is more quickly accomplished so that the operator is not exposed for so long to the effects of the gas. Satisfactory results have also been obtained with the dust fumigant, "Cymag," the price of which is so low that the cost of fumigating a native hut will be reduced to about one-third. Preliminary investigations have been begun on the flea, *Tunga penetrans*, L., which causes severe crippling among the native population. It appears to be most abundant in the richer agricultural areas and is generally associated with red-loam soils.

VICARS-HARRIS (N. H.). **The Occupation of Land reclaimed from the Tsetse Fly of Tanganyika.**—*E. Afr. Ann.* 1934–35, reprint 6 pp., 10 figs. Nairobi, 1935.

A brief account is given of the land that has been reclaimed from *Glossina* in Tanganyika Territory, particularly in the Shinyanga district, and of the means adopted to induce permanent settlement by natives. Between 1923 and 1931 some 140 square miles of country had been reclaimed by the natives in Shinyanga under the guidance of the Government; between 1927 and 1932 some 80 square miles were reclaimed in Mwanza Province, and a smaller area in Nzega was cleared and closely settled. In the Mbulu District in the Northern Province, over 200 square miles was made available in 1931 by cutting corridors and throwing open hitherto inaccessible plains. A rather more detailed account is given of the opening up of the Huruhuru plains for grazing and settlement [*cf. R.A.E.*, B **22** 230]. Unfortunately the corridor 1,200 yards wide leading to these plains was found to be too narrow for safety, as small numbers of flies were observed wandering into it and along the cattle track. Ultimately it is hoped to render free from fly an area three or four miles wide, but in the meantime cattle

were successfully taken through by sending trained native assistants with catching screens ahead of each herd. Not many flies were caught. An area of 150 square miles has been opened up, and the sojourn of cattle in it during the first season has been a great success.

WALKER (F.) & DIXON (D. S.). **The Bug-proof Construction of Native Dwellings.**—*E. Afr. med. J.* **12** no. 11 pp. 344–347, 2 figs. Nairobi, February 1936.

A brief description is given of the methods that have been found by experience on a large tea estate in Kenya to be of value in preventing infestation by bed-bugs [*Cimex hemiptera*, F.] in the dwellings of native employees [*cf. R.A.E.*, B **23** 210]. They comprise the swinging of doors (on pins fixed to the top and bottom) without the use of door frames ; the construction of bunks by supporting three loose bed boards on dwarf walls, or in the case of upper bunks, on angle irons bolted to the main walls ; the use of steel window frames ; the elimination of wall plates for fastening down roof members and, where possible, the elimination of roof trusses ; the use of angle irons bolted into the walls to carry the purlins about 3 inches above the walls ; and care in plastering to see that there are no crevices and that corners and the tops of walls are finished off round and smooth.

SHAFFI (Mohammad). **A Simple, cheap, and effective Fly-trap.**—*Agric. Live-Stk India* **6** pt. 1 pp. 60–62, 2 figs., 8 refs. Calcutta, January 1936.

The fly trap described, which is stated to be both cheap and effective, may be made of any kind of wood or metal. A box, 14 inches square by 5 deep, raised from the ground on short legs and having three holes 1 inch in diameter at the same level on each of two opposite sides, contains the bait in a small receptacle. In the centre of the removable lid of the box is a hole $2\frac{1}{2}$ inches in diameter into which fits an inverted funnel with an opening $\frac{1}{4}$ inch wide at the top. A wire gauze dish cover is placed over the funnel and fits into a groove on the lid. The flies, attracted by the bait, enter the box through the holes in the sides and fly up towards the light through the funnel into the cage. They are destroyed by immersing the lid of the box with the cage in hot water. The trap is kept near places frequented by flies, preferably in the shade and with one lot of entrance holes facing windwards.

Several cheap substances were tested as baits. One containing mustard oil cake yielded the best results with house-flies [*Musca domestica*, L.] and stale meat or fish with house-flies and blowflies, especially the latter. The mustard oil cake bait is prepared by soaking 4 oz. cake in water, mixing with it 2 oz. cow-dung and 2 oz. soil and allowing the mixture to ferment. It is ready for use after 36–60 hours in summer or 3 days in winter. In the trap it lasts for several days if it is kept moist, but should be changed as soon as it loses its odour. With this bait about 2,000 flies were attracted within 2 hours when the trap was placed near cattle sheds and manure pits where flies were abundant ; flies were also attracted from a distance. When two traps were kept close together, the catches in each were more than when a single trap was used. In order to prevent oviposition and breeding in the bait, it was covered with fine-meshed wire gauze.

Covell (G.). **Studies on Typhus in the Simla Hills. Part I. Introduction.**—*Indian J. med. Res.* **23** no. 3 pp. 701–708, 3 pp. refs. Calcutta, January 1936.

The author briefly reviews the research that has been carried out on the various forms of typhus fever and the history of the disease in India. In the Simla Hills [*cf. R.A.E.*, B **24** 91] there exist two types, the serum of one agglutinating strains of *Bacillus proteus* XK and not X 19 and the serum of the other giving the opposite reactions. In most of the cases there is no definite history of an insect or tick bite [*cf. loc. cit.*]. The XK type occurs during the two months immediately following the rainy season at a time when mosquitos, sandflies, ticks and fleas are abundant and biting freely ; there is annually a great increase in the numbers of fleas after the end of the rains. A strain of typhus has been isolated from rat fleas during the present investigation, but much more experimental work is necessary before it can be stated with certainty that the flea is the usual vector of the disease. The X 19 type occurs in mid-winter and early spring, and the evidence suggests that it is transmitted by an insect, such as the rat flea, that normally seldom infests man. Under conditions of extreme poverty and insanitation, however, transmission from man to man may be carried out by lice [*Pediculus*] ; this would explain outbreaks recorded in gaols in northern India and another epidemic in which the disease appeared to be contagious.

Lépine (P.). **Sur l'existence, en Indochine, de trois espèces au moins de fièvres exanthématiques.**—*Bull. Soc. Path. exot.* **29** no. 1 pp. 16–19, 11 refs. Paris, 1936.

The author points out that at least three forms of typhus occur in Indo-China, epidemic typhus transmitted by *Pediculus humanus*, L. [*cf. R.A.E.*, A **16** 251], benign typhus of murine origin, and a form possibly identical with tsutsugamushi disease.

Raynal (J.). **Méthode des précipitines appliquée au contenu stomacal de quelques phlébotomes du Tonkin.**—*Bull. Soc. Path. exot.* **29** no. 1 pp. 56–60, 11 refs. Paris, 1936.

The species of *Phlebotomus* that occur in northern Indo-China are *Phlebotomus stantoni*, Newst., *P. bailyi* var. *campester*, Sinton, *P. barraudi*, Sinton, *P. sylvestris*, Sinton, *P. iyengari*, Sinton, *P. argentipes*, Ann. & Brun., *P. hivernus*, Raynal & Gaschen, *P. sylvaticus*, Raynal & Gaschen, *P. morini*, Raynal & Gaschen, and *P. tonkinensis*, Raynal & Gaschen. The three most common species are *P. stantoni*, in the west (Tonkin), *P. bailyi* var. *campester* towards the south (north and central Annam), and *P. barraudi*, which is sometimes taken at low altitudes as are the other two, but is usually found alone at 3,900–5,200 ft. As these three species had nearly always been caught in the vicinity of dwellings, precipitin tests were made of the stomach contents of 30 specimens for the presence of human, cattle, dog or fowl blood. Only two positive results were obtained : one example of *P. barraudi* for human blood and one of *P. bailyi* var. *campester* for fowl blood.

Senevet (G.). **Qu'est-ce que le " pou d'agouti " de la Guyane ?**—*Bull. Soc. Path. exot.* **29** no. 1 p. 60. Paris, 1936.

The author discusses the possible identity of what is known in French Guiana as the " pou d'agouti." On two occasions when staying in Cayenne from July to September 1934, he collected from his person larvae of a species of *Trombicula* that had apparently been picked up from the grass through which he had passed. It seems probable that this mite is the " pou d'agouti," but it is possible that other Arthropods, such as the larvae of Ixodids, are also included under the same name.

Sergent (Et.) & Catanei (A.). **Influence du froid sur les oeufs d'*Anopheles maculipennis* du littoral algérien.**—*Arch. Inst. Pasteur Algérie* **13** no. 4 pp. 511–512, 1 ref. Algiers, 1935.

Unpublished experiments undertaken about 10 years ago show that the eggs of *Anopheles maculipennis*, Mg., in Algeria are more sensitive to cold than those in Corsica [*cf. R.A.E.*, B **24** 37]. A total of 63 experiments were carried out with 2,441 normal eggs laid during the hot season by females caught in the neighbourhood of Algiers. Eggs laid at a temperature of 25°C. [77°F.] were immediately placed at a constant temperature of 5°C. [41°F.] (the average winter minimum temperature in this region) for periods varying from 1 to 14 days, before being returned to the optimum temperature of 25°C. The length of the incubation period was found to increase in direct proportion to the time of exposure to cold, but after 8 days exposure some of the eggs did not hatch, after 10 days very few hatched, and after 14 days none. All the control eggs, which were left at 25°C., hatched in 1–2 days.

Calonne (R.). **La malaria dans le Haut-Ituri. Le danger des eaux de barrages.**—*Ann. Soc. belge Méd. trop.* **15** no. 4 pp. 501–520, 1 map. Brussels, 31st December 1935.

The author's investigations in the high plateaux of Ituri, Belgian Congo, have shown that malaria is normally rare among the natives, whereas both spleen and parasite rates are high in the vicinity of the artificial reservoirs that have been constructed to permit the cultivation of such crops as coffee. The two Anophelines recorded are *Anopheles gambiae*, Giles, and *A. christyi*, Newst. & Cart. Under natural conditions the rivers flow rapidly, particularly in the rainy season, and the water from springs on the hillsides is also moving. The valleys are sometimes slightly marshy, but the vegetation in these places is so thick that they are not suitable for Anophelines and no larvae were ever found in them. Moreover, the thick cold mists rising from these valleys prevent breeding and are incidentally very injurious to coffee. On the other hand, the reservoirs of stagnant water with irregular edges and abundant vegetation provide shaded water protected from the wind, which is suitable for oviposition. Moreover, the drainage of the valleys raises their nocturnal temperature by about 4–6°C. [7·2–10·8°F.] in both the cold and warm seasons, and, as a consequence, they become favourable for breeding in the warm season if the drains are badly made or are not well kept.

Thus the construction of these reservoirs has created zones of hyper-endemic malaria in their immediate vicinity and endemic malaria within a radius of about 1¼ miles in a region that is naturally almost free from the disease. For this reason it is suggested that the number of

such reservoirs should be restricted to a necessary minimum ; that they should be emptied during the warm season, when the larvae are present but the water is not required for the treatment of the coffee berries, or, where this is impossible, they should be treated with larvicides ; that the drains in the valleys should be properly maintained ; and that the administration of quinine to planters and their employees should be made obligatory so that they should not constitute a source of infection for neighbouring villages. The temperatures at this altitude have been found unsuitable for the establishment of larvicidal fish.

Wanson (M.). **Note sur les trous de crabes, gîtes larvaires.**—*Ann. Soc. belge Méd. trop.* **15** no. 4 pp. 575–585, 2 figs., 8 refs. Brussels, 31st December 1935.

The peninsula of Banana, situated at the mouth of the Congo, is bordered on one side by the Atlantic and on the other by a creek ; crabs are numerous, the species differing according to whether they inhabit the sea shore, the bank of the creek or the strip of land. In an examination made during September–December 1933 (dry season) 313 crab holes in the inhabited part of the port yielded about 2,000 adult mosquitos, including 264 examples of *Anopheles gambiae*, Giles, the only Anopheline recorded, 7 of *Aëdes aegypti*, L. (*argenteus*, Poir.), 16 of *A. africanus*, Theo., and 13 of *A. luteocephalus*, Newst. Only holes with a diameter greater than 2½ inches harboured mosquitos ; the smaller ones contained only small flies. Crab holes in sandy hillocks near pools distant from dwellings (brush region) harboured only species of *Aëdes* of the subgenus *Aëdimorphus*.

All attempts to find larvae in crab holes remained negative until the hot rainy season, when large numbers of larvae of *Anopheles gambiae* and of various Culicines were readily taken in the flooded holes ; 260 crab holes situated near the edge of the creek or inland, and flooded either by the spring tides or by rain, contained larvae. The negative results obtained in the dry season appear to have been due merely to the larvae being buried deeply by the falling in of the sand when attempts were made to open up the burrows, for in further examinations in the dry season in which use was made of a long tube and a suction apparatus, 200 out of 666 holes contained mosquito larvae. The crab holes on the seashore and those on the immediate edges of the creek, which are inundated by the daily tides, contained no larvae. Thus the holes of the terrestrial species, *Cardisoma armatum*, are the most important from the mosquito breeding point of view. The shape of these holes is described. The water surface is reached at depths that vary, according to the situation and the tides, from 27 to 47 inches in the dry season ; near marshes and pools, particularly in the wet season, the water may rise to within a short distance of the surface. A certain number of holes on the edge of the creek remain flooded in the dry season on account of the tides.

Among the methods used for dealing with these breeding places the most satisfactory was that of pouring boiling water into each hole to kill the crabs and the larvae and pupae of the mosquitos. Three men can easily treat 600–650 holes a day. From 15th September 1934 to 31st January 1935, 71,171 crabs were destroyed and their holes filled in. The best results with this method would be obtained in the last months of the dry season, the period when the crabs breed.

Experiments showed that the temperature required to kill larvae and pupae of mosquitos is 42°C. [107·6°F.]. Crabs weighing between 3½ and 10½ oz. died in 5–10 seconds at 62°C. [143·6°F.] when immersion was sudden. In experiments in the field these temperatures were usually surpassed, the boiling water raising the temperature of the water at the bottom of the holes to 68–73°C. [154·4–163·4°F.] according to the depth, and maintaining it above 50°C. [122°F.] for about 10 minutes, provided that a minimum of about a gallon was used. If less water is applied the treatment may be rendered ineffective owing to the absorption of the water by the walls of the burrows. The treatment is only effective for holes that are not flooded and therefore gives the most satisfactory results during the dry season.

A. gambiae may breed in these situations at all seasons and out of 417 breeding places discovered in 1934, 227 were crab holes. The burrows of *Cardisoma*, which are flooded in the hot season by rains and in the dry season by tides, do not harbour Anophelines unless the surface of the water is in sunlight. Larvae are not found in holes where the shade is too dense or where the surface of the water is about a foot below the ground level. Other species of mosquitos appear to be affected in the same way, and the number of species found in the holes of this crab undergo seasonal variations that are apparently correlated with the degree of illumination. The destruction of the crab holes has certainly had a beneficial effect on the malaria situation and has also rendered habitable dwellings in which the occupants had previously been subjected to severe annoyance by the bites of swarms of *Aëdes irritans*, Theo. No larvae of *A. aegypti* or *A. luteocephalus* were found in crab holes, which evidently serve only as day time resting places for these species. They apparently prefer to breed in rain water in holes in the branches of mangroves, but may oviposit in accumulations of salt water. The blood-sucking Ceratopogonid, *Culicoides wansoni*, Goetgh. [*cf.* *R.A.E.*, B **23** 207] abounds in the mud in the chamber at the bottom of the holes.

WANSON (M.). **Influences de la salinité sur la faune culicidienne.**—*Ann. Soc. belge Méd. trop.* **15** no. 4 pp. 587–598. Brussels, 31st December 1935.

The temperature at Banana, Belgian Congo, is high enough all the year round to permit the development of mosquitos, which appear in large numbers 12–13 days after rains or high tides. Although the rains appear to lead to the production of the largest number of mosquitos, the most dangerous breeding ground is the part of the shore that is only covered by spring tides. These leave holes and depressions full of sea water and crab holes in which breeding of mosquitos, including *Anopheles gambiae*, Giles, takes place until the next spring tide. Natural depressions filled with rain water often attain a degree of salinity greater than sea water owing to seepage (the soil having a high content of chlorides) and to evaporation. A total of 14,429 adult Anophelines caught throughout the year 1934 in dwellings or in the uninhabited part of the peninsular all proved to be the type form of *A. gambiae*; they were particularly numerous between February and June, especially in the native quarter. Larvae of *A. coustani*, Lav. (*mauritianus*, Grp.) were found in one of 417 breeding places positive for Anophelines; this pool was the only one in which the salt content was as low as 0·10 gm. chloride per litre.

Staining experiments showed that some of the adults taken at Banana had migrated from the north and from islands in the vicinity. The adults of *A. gambiae* were of two types, large (in which the wings measured 3·38 mm. or more) and small (in which they measured 3·35–3·37 mm.). The maxillary indices of the two types were identical, the average being 12·24. The average number of eggs laid by females in the laboratory was low, being 43 in fresh water and 89 in salt. It was not apparently affected by the size of the adult. Mature eggs were found in the ovaries of females caught at intervals throughout the dry season. There is apparently no morphological difference between the eggs of the two types. Adults of both types are derived from larvae living in salt water and neither can pair in a confined space. Small adults were most often obtained throughout the year from crab holes and from tidal breeding places containing numerous larvae, whereas larvae taken from large pools usually gave rise to larger adults, particularly in the hot season. It would thus appear that the reduction in size is due to larval competition and intoxication by the products of excretion in breeding places having a small surface. Salinity has the same effect at concentrations greater than 45 gm. chlorides per litre. Small scale anti-larval measures have given promising results. The artificial filling of the large marshes inland should be undertaken, and supervision should be extended to the northern part of the peninsular and to the islands in the vicinity.

A. gambiae is the only Ethiopian Anopheline known to be adapted to breeding in salt water. Females of *A. coustani* var. *ziemanni*, Grünb., sent from villages in the interior were placed, after engorging on human blood, in cages where they had access to fresh water and water from a pool containing 6 gm. chloride per litre. Fewer batches of eggs were laid in the salt water, and all larvae died on the day they emerged, whereas adults were obtained in 12–13 days from the eggs laid in fresh water. The adaptation of *A. gambiae* to waters of varying salinity is discussed. At the end of the rainy season this mosquito avoids the waters of high salinity in rain-water breeding places subject to evaporation and migrates to the edge of creeks to lay in tidal breeding places in which the salinity rarely exceeds 25 gm. per litre. On the other hand females will lay with equal readiness in receptacles containing fresh or sea water. The larvae are very resistant at all ages and may be removed without apparent ill effect from salt to fresh water and from fresh to salt water with a salinity that may be as high as 60 gm. per litre. In the laboratory engorged females laid eggs in fresh water and water containing up to 60 gm. per litre but not in water containing 80 and 100 gm. The optimum conditions would appear to be provided by water with a salinity of 15–25 gm. per litre, a salinity that obtains in all collections of salt water on the edge of the Atlantic at the mouth of the river. A table is given showing the degree of salinity of the collections of water in which the various species of Culicines were found.

Baker (F. C.). **The Effect of Photoperiodism on Resting, Treehole, Mosquito Larvae.** **(Preliminary Report.)**—*Canad. Ent.* **67** no. 7 pp. 149–153, 6 refs. Orillia, July 1935.

Attempts to reactivate resting larvae of mosquitos collected from tree-holes in autumn by maintaining them at temperatures favourable

for development, by exposing them to ethylene chlorohydrin gas or by alternately freezing and thawing them before placing them in a warm room, were unsuccessful. Observations on the life-cycles of the fauna of tree-holes in the vicinity of Ithaca, New York, showed that many assumed the resting stage before frost occurred in the autumn and became active while freezing weather still prevailed in the spring. The duration of daylight at the time of year when suspension of activity begins coincides almost exactly with the duration of daylight at the time of year when development is resumed. Experiments were therefore undertaken to determine whether the duration of daylight might be the factor limiting activity when temperatures are favourable. Eggs of *Aëdes triseriatus*, Say, which overwinters in the egg stage, were deposited on a stick above water during the summer of 1934. They could not be induced to hatch during October and November by soaking the stick in water, although all of those examined contained fully developed embryos. The batch was divided into two lots, one of which was exposed to daylight and to electric light for six additional hours each evening for five weeks, whereas the other received indirect daylight and hardly any artificial light. At the end of this time the eggs were submerged in filtered tree-hole water. After 18 hours two larvae had hatched from the second lot and no further hatchings took place, whereas the water containing the eggs exposed to supplemented light was swarming with larvae that subsequently developed and gave rise to adults. In a similar experiment begun in January 1935, two lots of larvae of tree-hole mosquitos were kept under similar conditions except that they were given the amounts of light normally received in December and June respectively. Records made each week for four weeks revealed continuous growth and the appearance of pupae and emerging adults in the batch exposed to the longer periods of light, whereas no signs of development were observed in the other batch. All attempts to return activated larvae to the resting condition by again subjecting them to short periods of light were unsuccessful. It is concluded that the length of daylight (photoperiod) is the dominant factor initiating the rest period in the autumn and bringing about larval activity in the spring.

Boyd (M. F.) & Stratman-Thomas (W. K.). **The Transmission of Quartan Malaria through two consecutive Human-Anopheline Passages.**—*Amer. J. trop. Med.* **16** no. 1 pp. 63–65, 1 ref. Baltimore, Md, January 1936.

In further experiments females of *Anopheles quadrimaculatus*, Say, recovered *Plasmodium malariae* from one of the men previously infected by means of this Anopheline [*cf. R.A.E.*, B **21** 182], and transmitted it to two negroes after 38 and 39 days respectively but not to a white man after 37 days. Sporozoites were found in the salivary glands of the mosquitos after 34 days at about 20°C. [68°F.], and it is thought that the failure to transmit on the 37th day may have been due to the fact that the parasites had not had sufficient time to reach the salivary duct. Apparently the attacks in the two negro patients were too short to allow of adequate gametocyte production ; so few gametocytes were observed that no further attempts were made to propagate the strain by means of mosquitos.

Boyd (M. F.) & Kitchen (S. F.). **The comparative Susceptibility of** *Anopheles quadrimaculatus*, **Say, and** *Anopheles punctipennis*, **Say, to** *Plasmodium vivax*, **Grassi and Feletti, and** *Plasmodium falciparum*, **Welch.**—*Amer. J. trop. Med.* **16** no. 1 pp. 67–71, 3 refs. Baltimore, Md, January 1936.

In continuation of a previous study [*R.A.E.*, B **22** 206], experiments were undertaken to test the relative susceptibility of *Anopheles quadrimaculatus*, Say, and *A. punctipennis*, Say, to infection with *Plasmodium vivax* and *P. falciparum* by simultaneously applying a batch of each species to an infected man. In 7 out of 8 tests with one strain of *P. vivax* the rate of infection in *A. punctipennis* was lower than in *A. quadrimaculatus* ; in the single experiment with a second strain it was higher. The rates of infection in *A. quadrimaculatus* were somewhat higher than in the previous series of experiments [*loc. cit.*]. The results with four strains of *P. falciparum* were not so consistent. The batches of *A. quadrimaculatus* were all infected, but the percentage varied widely with the different strains. In 4 out of 9 batches of *A. punctipennis* the results were negative, and in the other 5 the percentage of infection varied from 8·3 to 94·5. A comparison of the quantitative infection confirmed the suggestion that *A. punctipennis* is as efficient a vector of *P. vivax* as *A. quadrimaculatus* and that both species vary widely in their susceptibility to different strains of *P. falciparum.*

Although the susceptibility of *A. punctipennis* has been demonstrated, no gland infections and only one stomach infection have been reported in females caught in nature. In Florida and southern Georgia it is most prevalent during the winter, on the coast of North Carolina in the spring and autumn, and in the northern States in the summer. Thus in the southern and coastal regions its maximum incidence does not coincide with the malaria season. Under insectary conditions, it is a vicious biter, but field observations in the south suggest that it is only infrequently present in houses, and precipitin tests on blood found in the stomach of wild specimens indicate that it feeds on animals more often than on man.

Lane (J.). **Notas sobre culicideos de Matto Grosso.**—*Rev. Mus. paulist.* **20** pp. 173–206, 4 pls., 28 refs. S. Paulo, 1936.

This list of mosquitos collected at Ponce in the Brazilian State of Matto Grosso from July to September 1934 (dry season) includes the following Anophelines : *Chagasia fajardoi*, Lutz ; *Anopheles eiseni*, Coq. ; *A. gilesi*, Neiva (of which the male is described) ; *A. peryassui*, D. & K. ; *A. mediopunctatus*, Theo. ; *A. parvus*, Chagas ; *A. argyritarsis*, R.-D. ; *A. bachmanni*, Petrocchi ; *A. tarsimaculatus*, Goeldi ; and *Anopheles* (*Stethomyia*) sp., either *A. nimbus*, Theo., or *A. thomasi*, Shannon.

Missiroli (A.). **Sulle caratteristiche termiche dei focolai di** *Anopheles plumbeus*. [On the thermal Characters of the Breeding Places of *A. plumbeus*.]—*Riv. Malariol.* **14** (1935) sez. 1 no. 6 pp. 449–456, 3 graphs. Rome, February 1936. (With a Summary in English.)

During observations on *Anopheles plumbeus*, Steph., in Italy [*R.A.E.*, B **23** 202], it was observed that fourth-instar larvae of the winter

generation kept at 16–18°C. [60·8–64·4°F.] failed to pupate. When they were kept at 24°C. [75·2°F.], so many died that the others were returned to the lower temperature.

After reference to two recent papers on the effect of temperature on insects [A **23** 751, 753], an account is given of investigations on the temperature of the water in breeding places of *A. plumbeus* among rocks around Lake Nemi and of *A. maculipennis*, Mg., along the sloping edges of the same lake. Recording thermometers were used from July to September. In the breeding places of *A. plumbeus* the temperature was constant at 15–16°C. [59–60·8°F.], which must therefore be the optimum for this species. Higher temperatures reduced larval vitality and lower ones prolonged larval development, 3 months being required at 9–10°C. [48·2–50°F.]. In breeding places of *A. maculipennis* (mainly var *labranchiae*, Flni.) there was a daily temperature oscillation from about 20°C. [68°F.] to over 30°C. [86°F.]. It thus appears that alternating temperatures favour the larvae. The negative phototropism observed in *A. plumbeus* [*loc. cit.*] leads it to oviposit in water with the constant temperature required by its larvae. *A. claviger*, Mg. (*bifurcatus*, auct.) and *A. algeriensis*, Theo., are thought to have similar habits as they breed chiefly in pits or other places sheltered from the sun, and *A. superpictus*, Grassi, which prefers mountain streams, is also probably favoured by a constant temperature. It is suggested that the various races of *A. maculipennis* develop in different thermal zones. As var. *labranchiae* breeds in Italy mainly in May and June, its optimum water temperature would probably be between 15 and 25°C. [59–77°F.]. It is also probable that *A. sacharovi*, Favr (*elutus*, Edw.), which the author regards as one of the varieties, has its optimum slightly higher and that var. *maculipennis* (*typicus*) develops most rapidly in water with a less wide variation. This would explain differences in the distribution of these varieties at different seasons and in the different parts of a given centre.

COMPAGNINI [G.]. **Cambiamento dei caratteri somatici della fauna anofelica nella bonifica di S. Eufemia. (2a Nota.)** [The Change in the Somatic Characters of the Anopheline Fauna in the Improved Area of S. Eufemia. (Second Note.)]—*Riv. Malariol.* **14** (1935) sez. 1 no. 6 pp. 457–468, 1 map, 3 graphs. Rome, February 1936. (With a Summary in French.)

Continuing investigations on the Anopheline fauna of a district in Calabria where drainage and other improvements have been carried out [*R.A.E.*, B **22** 199], further records were made of the seasonal and local prevalence there of adults of the races of *Anopheles maculipennis* Mg., including *A. sacharovi*, Favr (*elutus*, Edw.). *A. maculipennis* var. *atroparvus*, van Thiel, was not found. Var. *messeae*, Flni., predominated early, but was displaced from June to September by var. *labranchiae*, Flni. Var. *maculipennis* (*typicus*) occurred, though only in small numbers, in June and July, and *A. sacharovi* in August and September. The maxillary index of each race varied within certain limits according to the time and place of capture. Multidentate females predominated in areas with a fair degree of agricultural development, independently of drainage [*loc. cit.*].

PECORI (G.) & ESCALAR (G.). **Relazione sulla campagna antimalarica nell'Agro Romano durante l'anno 1934.** [Report on the anti-malarial Campaign in the Area around Rome during 1934.]—*Riv. Malariol.* **14** (1935) sez. 1 no. 6 pp. 469–519, 1 map, 2 graphs. Rome, February 1936. (With a Summary in French.)

Work against malaria was continued in the country-side around Rome during 1934 [*cf. R.A.E.*, B **23** 59]. Points of importance were the continued decrease of malignant tertian [*Plasmodium falciparum*] and the decrease of relapses of both malignant and benign tertian [*P. vivax*]. The first males of *Anopheles maculipennis*, Mg., were taken on 16th April and the last on 5th November. Paris green and Carburol were again used against the larvae, and a successful experiment was made with calcium cyanamide [**23** 204]. *A. maculipennis* predominated absolutely, only a few examples of *A. claviger*, Mg. (*bifurcatus*, auct.) being taken, and all three Falleroni egg-types [**22** 98, etc.] were found.

In the district of Ardea the great and progressive decrease of malaria (from 32·26 per cent. in a population of 530 in 1931 to 5·3 per cent. in 660 in 1934) was obtained by zooprophylaxis in spite of the predominance there of *A. maculipennis* var. *labranchiae*, Flni., which is generally supposed to persist in entering bedrooms even when domestic animals are abundant [*cf.* next paper]. The 20 special pig-sties built in 1932 [**22** 35] were increased by 7 in 1933 [**22** 138] and by a further 5 in 1934. In 1931 the total number of Anophelines captured was 4,791, of which 70 per cent. were in dwellings and 30 per cent. in pig-sties and other animal quarters. The corresponding figures in the next three years were 24,276, 9·7 and 90, 26,657, 2·3 and 97, and 27,256, 2·03 and 90, respectively.

HACKETT (L. W.). **Les races d'*Anopheles maculipennis*.**—*Riv. Malariol.* **14** (1935) sez. 1 no. 6 Suppl. pp. 48–57. Rome [1936].

The author discusses the theories put forward to account for the absence of malaria in localities where Anophelines are abundant, and the discovery of the races of *Anopheles maculipennis*, Mg., among which he includes *A. sacharovi*, Favr (*elutus*, Edw.).

Var. *maculipennis* (*typicus*), var. *atroparvus*, van Thiel, var. *melanoon*, Hackett, and var. *messeae*, Flni., do not usually transmit malaria in Italy, the disease being limited to localities where *A. sacharovi*, and particularly var. *labranchiae*, Flni., are found. Var. *atroparvus* is a vector in Spain and Portugal and the only vector north of the Alps. The larvae of these three vectors breed in brackish water and as a consequence the distribution of the disease tends to follow the coast line. In certain coastal regions where there is no malaria the breeding places have been found to contain fresh water, and in inland areas where malaria occurs the breeding places are often springs or lakes of salt water. The distribution of malaria in Europe coincides with that of the dangerous races, and these races are dangerous because they persist in entering houses and biting man even in localities where domestic animals are numerous; the other races are attracted away from houses by animal sheds [*cf. R.A.E.*, B **22** 201]. The distribution of the races depends on the type of breeding place in each region. In general *messeae* prefers stagnant water in the large river valleys of the interior of Europe, *melanoon* rice-fields and fresh water marshes [*cf. loc. cit.*], the typical form streams in mountainous regions, and the

other three races brackish water in lakes and marshes on the sea coast, although *atroparvus* may also breed in fresh water. As a consequence malaria has little relation to the economic status of the local population. The systematic position of the varieties is discussed [*cf.* **22** 198, 201].

HACKETT (L. W.). **Méthodes biologiques de lutte antipaludéenne.**—*Riv. Malariol.* **14** (1935) sez. 1 no. 6 Suppl. pp. 58–70. Rome [1936].

By means of the precipitin test it has been possible to determine the natural preferences of various Anophelines, particularly the races of *Anopheles maculipennis*, Mg., for human or animal blood, and malaria in Europe may be divided into two types according to the habits of the vectors. Where these are anthropophilous, the intensity of the disease will depend directly on their abundance, for man will be attacked even when domestic animals are present. Where they are zoophilous, the amount of malaria will depend on the existence of conditions, such as paucity of domestic animals or excessive abundance of Anophelines, which induce the mosquitos to bite man, or on the presence of large numbers of gametocyte carriers, which render their bites more dangerous. These conditions may be due to a primitive type of agriculture, to social or economic upheavals or to a pioneer stage of civilisation. In the first case control measures must aim at the eradication of breeding places and the protection of houses against adults, whereas in the second malaria may be eliminated by measures raising the economic status of the people so that the consequent increase in the abundance of domestic animals may furnish a sufficient food supply for the mosquitos.

From the malaria point of view, one of the most effective modifications of the primitive type of agriculture has been the introduction of crop rotation, which has led to the cultivation of leguminous crops for the fertilisation of the soil, and consequently to an increase in the number of domestic animals to consume the excess forage thus produced.

Anopheles sacharovi, Favr (*elutus*, Edw.) and *A. maculipennis* var. *labranchiae*, Flni., appear to be anthropophilous throughout their range, and malaria occurs wherever they are found. For reasons that have not yet been elucidated, *A. maculipennis* var. *atroparvus*, van Thiel, is anthropophilous in certain regions, notably Spain and Portugal, and zoophilous elsewhere. Var. *maculipennis* (*typicus*), var. *messeae*, Flni., and var. *melanoon*, Hackett, are primarily zoophilous, and where these forms occur, malaria may be absent, or present in degrees varying from a few sporadic cases to high endemicity.

The anthropophilous forms, including var. *atroparvus*, breed chiefly in brackish water and the zoophilous forms in fresh water [*cf.* preceding paper]. Instances are given in which modification of brackish water breeding places (by substituting fresh water, by increasing salinity, etc.) has led to the replacement of the former by the latter. In a case where the salinity was increased, the larvae of *A. sacharovi* disappeared before the salt content reached the minimum lethal concentration of 2 per cent. ; it is thought that the plankton and algae were more sensitive than the larvae and that the destruction and decomposition of the vegetation rendered the water unsuitable for breeding. The type of vegetation, and consequently the species of Anopheline in the breeding place, depend on the depth of the water. In shallow

water vegetation tends to be submerged and horizontal and in deeper water vertical and emergent; in water more than 6 feet deep both vegetation and larvae are usually absent. In one case the dredging of the edges of a lake augmented the depth of the water and diminished the quantity of vegetation and the numbers of larvae. Fluctuations in water level also bring about changes in the type of vegetation and often suppress breeding. As a rule "bonification" (the drying of marshes by drainage, the addition of lime and fertilisers to the soil and the introduction of irrigation) brings about subtle changes in the surface water that will gradually affect the races of *maculipennis* in the region and may ultimately prove as effective in malaria control as the elimination of breeding places by drainage, etc.

The type of house and its degree of illumination or humidity are not considered to affect transmission, which depends solely on the type of Anopheline. Although some houses may be preferred to others as day-time resting places, the numbers of Anophelines in such shelters do not necessarily bear any relationship to the number of cases of malaria that occur there. Thus the only important difference between one house and another is the presence or absence of mechanical protection.

Bana (F. D.). **A practical Way of dealing with** *Aëdes aegypti* (*Stegomyia fasciata*) **Mosquito Breeding in Country Craft.**—*Indian med. Gaz.* **71** no. 2 pp. 79–80. Calcutta, February 1936.

A survey of country boats entering Bombay harbour for local trade (carried out between 26th February and 13th April 1935) showed that *Aëdes aegypti*, L., was breeding in the drinking water barrels or boxes in 458 instances out of 898. These receptacles have small openings at the top, which are used for filling and for withdrawing water and have no properly fitting lids. They are never emptied completely, and water is added as required at the various ports of call. In spite of a lack of statutory authority, it was found possible to persuade the owners to empty, clean, dry and refill them in 385 cases. There is, however, need for legislation to enforce the installation of mosquito-proof tanks with a properly fitting lid and a tap for drawing off the water at the bottom, and to give the necessary authority to inspect and to prosecute in cases of non-compliance with this regulation.

Gill (C. A.). **Some Points in the Epidemiology of Malaria arising out of the Study of the Malaria Epidemic in Ceylon in 1934–35.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 5 pp. 427–466, 1 pl., 16 figs., 23 refs. London, 29th February 1936.

The main part of this paper, which deals with the epidemiological aspect of the malaria epidemic that occurred in Ceylon in 1934–35, and particularly with the mechanism of the epidemic wave, is preceded by a brief account of the topography, physiography, climate and population of the Island, and by a short review of the epidemic, including its distribution, and its relation to cyclical and seasonal epidemic periodicity, to drought and rainfall, and to *Anopheles culicifacies*, Giles [*cf. R.A.E.*, B **24** 92, 93].

The difficulty of accounting for sudden and widespread outbreaks of malaria at times when the spleen rate is low and when malaria parasites, particularly gametocytes, can scarcely be detected in the peripheral

blood led to a close investigation of happenings at the onset of the epidemic. It was found that the onset was remarkably abrupt throughout the epidemic area (although the epidemic began about one month earlier in the north than in the south). From a comparison of graphs showing morbidity and mortality in Ceylon and during a similar outbreak in India, it is concluded that the primary wave of morbidity associated with malaria epidemics is characterised by four peaks (the second of which is the highest) at intervals of approximately four weeks, but that the primary wave of mortality has only three peaks, also at intervals of four weeks. The morbidity curve rises abruptly, whereas the mortality curve rises gradually and does not reach its maximum point (first peak) until about ten weeks after the onset of the epidemic. The most striking feature of the mortality statistics is the absence of any appreciable increase of mortality amongst infants and children until the seventh week of the epidemic. The explanation of this point is discussed, and it is concluded that children must have escaped infection almost completely during the first four weeks of the epidemic. If this be so, it is difficult to believe that morbidity among adults at this period was mainly due to new infections, since this would imply that infected Anophelines had selected adults only for attack. Moreover, it would be necessary to assume that a large number of Anophelines had become infected at the same time from such human carriers as existed during a period of good health, and had then infected a large number of persons (excluding children) who subsequently fell ill at the same time. As this sequence of events appears improbable, it is held that the sickness during the first month of the epidemic was mainly due to an " epidemic of relapses."

On this basis, the happenings during the epidemic wave can readily be interpreted. The absence of marked change in the age-distribution of patients at the outbreak of the epidemic in October 1934 would indicate that the relapses were a reflection of the pre-existing proportion of human carriers in each age group. If the first peak of morbidity was due to relapses, the first new infections, the second peak of morbidity, would be expected about one month later, allowing ten days for the appearance of mature gametocytes in the peripheral blood, ten days for the cycle in the mosquito, and ten days as the incubation period in man. The third and fourth peaks would also be expected at intervals of a month, but the removal by death of the most susceptible persons and the rising immunity of the population would tend to reduce the magnitude of each successive wave, so that the second peak would be the highest. The first sharp rise in mortality in the seventh week, which is largely due to deaths among children, would thus be associated with new infections due to the bites of Anophelines infected from the relapse cases, an illness of one week's duration being the average for children and two week's for adults. In the light of this interpretation, the mortality peak that reached its acme in the middle of January would reflect new infections contracted in December, and the peaks in February and March would reflect the mortality associated with the third and fourth peaks of morbidity in January and February respectively. A second morbidity wave occurring in April was associated with an appreciable rise in the infection rate of Anophelines and was followed by a wave of enhanced mortality. It is regarded as a replica on a smaller scale of the primary wave, and as being initiated, like the first wave, by a wave of relapses. The main difference is that in April 1935 the rise in mortality occurred about two weeks after the rise in morbidity,

but this is in accordance with expectations, since there was a widespread human reservoir in April and not in October 1934.

Thus it appears that two factors are involved in the production of the epidemic wave. The first and most important is concerned with the change in the relationship of the malaria parasite and the human host, leading to an epidemic of relapses. The second is concerned with the number of Anophelines capable of transmitting infection and the number of non-immune persons capable of being infected. If environmental conditions are not favourable to transmission, it is reasonable to suppose that the epidemic of relapses will not be followed by a wave of new infections, and it is possible that this may explain the " spring rise " of malaria in Northern India and the " delayed primary infections " and " recurrences " that occur in Europe in the spring.

The first wave of the Ceylon epidemic was preceded by a sharp rise of atmospheric humidity three weeks before the outbreak, and the second wave in April was preceded by another such rise about a month previously. It is assumed as a working hypothesis that a sharp rise of relative humidity during the pre-epidemic period is in some way associated with the occurrence of a qualitative change in the malaria parasite, a change in the " epidemic potential," at the beginning of epidemics, but it is not suggested that it exercises any direct influence upon the malaria parasite, since it may be only the reflection of the influence of some other factor or factors, with which it is closely correlated. This hypothesis is adopted because it appears to provide a means of explaining many hitherto obscure features exhibited by malaria epidemics.

An epidemic of high intensity can only occur where the proportion of children (non-immunes) is high, where there is an adequate reservoir of infection, an abundance of vectors and environmental conditions favourable for transmission. Given these conditions, the distribution of the epidemic and its focal character will be determined by the magnitude of the " epidemic potential," and it is perhaps significant that the focal distribution of the Ceylon epidemic corresponds closely with the excess over normal of the rise of relative humidity in October 1934. In the area of highest intensity, not only was the " epidemic potential " higher than elsewhere, but also the spleen rate was moderately high (not too high to occasion a low proportion of children nor too low to be unfavourable to the occurrence of a widespread epidemic of relapses). Moreover, conditions were favourable for transmission and the effect of drought on the river beds had led to an increase in the local vector, *Anopheles culicifacies*. To the south of the epidemic area, the epidemic potential is normally extremely low and so also is the spleen rate (0–5 per cent.). Thus no appreciable epidemic would be expected to occur in this area, in spite of the drought and famine and the high proportion of non-immunes, even if the number of vectors were sufficient, which is doubtful. In the hyper-endemic area the intensity (as measured by mortality) would not be expected to be high in spite of a high epidemic potential, owing to the small number of children and the high degree of communal immunity. The part ascribed to the epidemic potential may also explain why epidemics show a tendency to recur in approximately the same area.

The hypothesis also explains why epidemics may follow abnormal drought or abnormal rainfall. In the Punjab where the atmospheric humidity is low, excessive rainfall brings about a sudden sharp rise ; in the wet zone in Ceylon where atmospheric humidity is normally

high, the drought brought about a gradual decrease, and the rainfall in October, although below normal, induced a sudden sharp rise. In view of the part attributed to droughts and floods in determining epidemic malaria, it follows that meteorological cycles associated with their occurrence at periodic intervals would occasion a similar periodicity of malaria epidemics. At the period of maximum and minimum sun-spot numbers, the weather is subject to extremes, with the result that droughts and floods are very liable to occur at these two periods, particularly the latter. The sun-spot cycle is of variable duration, the time elapsing from one period of minimum numbers to the next varying between 10 and 12 years. A graph based on the annual sun-spot numbers during the period 1810–1934 shows the association of years of minimum sun-spot numbers with great epidemics and pandemics of malaria. The recent epidemic in Ceylon coincided with the new sun-spot cycle beginning in 1934. Malaria epidemics are also associated with the periods of maximum sun-spot numbers. Thus it would be expected that epidemics would exhibit a tendency to occur at intervals of five and more especially of ten years. The oscillations of solar activity of which sun-spot cycle is one manifestation are also associated with magnetic disturbances, and it is therefore conceivable that variations in the quality or quantity of solar radiation at the time of maximum and minimum sun-spot numbers may be the cause of the outbreak of relapses at the commencement of malaria epidemics.

CHEVERTON (R. L.). **Irritation caused by Contact with the Processionary Caterpillar (Larva of *Thaumetopoea wilkinsoni* Tams) and its Nest.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 5 pp. 555–557, 1 pl., 4 refs. London, 29th February 1936.

In Cyprus, *Thaumetopoea wilkinsoni*, Tams, is found on all species of pine, particularly *Pinus halepensis* [*cf. R.A.E.*, A **14** 621]. Contact with the caterpillar or with the dust from its nests will give rise almost instantaneously to large urticarial weals and intense irritation that will last as long as the dust remains on the clothing. A case in which the eyes were affected is described. The villagers report difficulty in swallowing if they have drunk from a well over which is hanging a pine tree containing a nest. The identity of the toxic agent is discussed.

SMART (J.). **Notes on the Simuliidae occurring at Fortingal, Perthshire.** —*Scot. Nat.* no. 217 pp. 22–26, 6 refs. Edinburgh, 1936.

Of the 7 species of *Simulium* that occur in the district of Fortingal, Perthshire, only *S. hirtipes*, Fries, and *S. reptans*, L., were seen biting, the former on cattle and the latter on the human arm. They all hibernate as larvae. *S. hirtipes* is univoltine, while the others have 2 or possibly more generations each season. Larvae of *S. hirtipes* of an identifiable size were not found in the streams until the autumn following the emergence of the flies in the spring. The pupal stage lasts for about 8 days.

LIPSTEIN (I.). **Transmission de *Spirochaeta novyi* par *Pediculus corporis*. Contribution à la technique de l'élévage des poux.**—*Ann. Parasit. hum. comp.* **14** no. 2 pp. 113–125, 1 pl., 23 refs. Paris, 1st March 1936.

In this paper notes are given on the biological characters of *Spirochaeta novyi*, on the history of a strain since it was brought from

America to France in 1933, on the biology of the louse, *Pediculus humanus*, L., on methods of rearing it, and finally on experiments in which the spirochaete was successfully transmitted from rat to rat.

P. humanus can only be successfully reared by feeding it on man. Animal blood appears to be toxic, and in experiments in which the lice were fed on rats infected with *S. novyi* 90 per cent. died. The period of growth varies according to the temperature and the number of meals. In this work the lice were kept at 35°C. [95°F.] during the night and at the same temperature or at 24°C. [75·2°F.] during the day. They were fed on man in the morning and evening for at least an hour. Under these conditions, the eggs hatched in 6–10 days, the three moults took place in the course of 15 days on the average, pairing occurred immediately after the last moult, and the first eggs were laid within 24–48 hours.

When the lice were to be fed on a rat, they were placed inside a glass ring 2–3 cm. high attached to the shaved abdomen of the rat. Ordinarily the lice were kept in a small wooden box with a removable lid. The bottom is formed of bolting silk through which they can feed on man when the box is strapped to the arm or leg, and in the lid there is a circular hole covered with bolting silk to admit air. Between feedings the box is placed on the open end of a Borrel tube fixed upright in a bed of wet cotton wool in a glass jar that acts as a humidity chamber. The excreta of the lice fall through the bolting silk into the bottom of the tube. The eggs are laid on small pieces of cotton twist placed in each box. Bolting silk with a mesh of 1 mm. is usually satisfactory in cages for adults, but a smaller mesh should be used in rearing larvae. Boxes containing adults should be cleaned or changed every five days to avoid the risk of the eggs hatching and the young larvae dropping through the meshes of the silk at the moment when the box is being removed from the skin. The box containing the larvae need not be changed for 10 days, after which the fine-meshed silk should be changed for the coarser variety. It was easy to rear 250–300 lice in each box. Every five days 50 bits of twist carrying about 1,500–2,000 eggs were removed.

In four experiments lice were fed on rats infected with *S. novyi*, and suspensions were made of the engorged individuals and inoculated into healthy rats at various intervals after the infecting feed. Results were positive when the interval was 24 hours or 7, 8, and 9 days and negative when it was 2 and 5 days. The strain is fatal when inoculated directly from rat to rat, but relatively benign when transmitted by means of suspensions of lice. In one experiment, lice were dissected at intervals from $\frac{1}{4}$ to 24 hours after feeding on an infected rat. Examination of the stomach contents revealed actively motile spirochaetes only during the first 25 minutes. After 40 minutes their number diminished, and after $3\frac{1}{2}$ hours they were inactive. None was seen on the following day.

SAUTET (J.). **Invasion domiciliaire de *Rhipicephalus sanguineus* et de *Teutana triangulosa*. Rôle ixodiphage des araignées.**—*Ann. Parasit hum. comp.* **14** no. 2 pp. 126–129, 1 fig., 3 refs. Paris, 1st March 1936.

The author records the invasion of a house in Corsica by numbers of *Rhipicephalus sanguineus*, Latr. (which probably came from two dogs

kept outside) and at the same time by the Theridiid, *Teutana triangulosa*, Wlck., which fed on the ticks. The spiders were easily kept in captivity in lamp glasses with two or three small pieces of wood on which to spin rudimentary webs. They fed on engorged ticks of all stages. Their life-cycle from egg to adult lasted about three weeks in August. Females produced an average of 8–10 spherical balls of webbing, each containing 6–12 eggs. The young spiders hatched in a few days and began at once to feed on the ticks. When ticks and flies were given at the same time, the spiders attacked the ticks; flies were only attacked when they alone were supplied.

Papers noticed by Title only.

PANAYOTATOU (A.). **Sur les "leishmanioses" en Méditerranée** [Review of data on cutaneous and visceral leishmaniasis].—*Rev. Méd. Hyg. trop.* **27** no. 6 pp. 279–310, many refs. Paris, 1935.

SHIRAKI (T.). **Simuliidae of the Japanese Empire** [including 22 new species].—*Mem. Fac. Sci. Agric. Taihoku* **16** no. 1 (Ent. no. 7) pp. 1–90, 14 pls. (4 col.), 4 pp. refs. Taihoku, Formosa, July 1935. [Recd. February 1936.]

PHILIP (C. B.). **The** *furcatus* **Group of western North American Flies of the genus** *Chrysops* **(Diptera: Tabanidae).**—*Proc. ent. Soc. Wash.* **37** no. 8 pp. 153–161. Washington, D.C., January 1936.

BAKER (F. C.). **A new Species of** *Orthopodomyia, O. alba* **sp. n.** [from New York State]. **(Diptera: Culicidae).**—*Proc. ent. Soc. Wash.* **38** no. 1 pp. 1–7, 10 figs. Washington, D.C., February 1936.

RIPSTEIN (C.). **Los mosquitos del Valle de Mexico. III.** *Culex fatigans* **Wied. IV.** *Culex apicalis* **Adams. V.** *Culex stigmatosoma* **Dyar.**—*An. Inst. Biol. Univ. Mex.* **6** no. 3–4 pp. 213–233, 21 figs., 7 refs. Mexico, D.F., 1935. (With Summaries in German.) [*Cf. R.A.E.*, B **23** 119, 191.] [Recd. February 1936.]

BEQUAERT (J.). **Notes on Hippoboscidae. 6. A preliminary Account of the Species known from Chile.**—*Rev. Chil. Hist. nat.* **37** pp. 160–165. Santiago, Chile, 1933. [Recd. February 1936.]

THOMPSON (G. B.). **A Check List of the Hippoboscidae and Nycteribiidae parasitic on British Birds and Mammals.**—*Ent. mon. Mag.* **72** no. 863 pp. 91–94, 13 refs. London, April 1936.

ROTHSCHILD (M.). *Megabothris* [*Ceratophyllus*] *rectangulatus* **Wahlg. 1903, a Flea new to Great Britain.**—*Novit. zool.* **39** no. 4 pp. 270–274, 6 figs. Tring, 16th March 1936.

JORDAN (K.). **Siphonaptera from Congo Belge** [including a new species and a new subspecies].—*Novit. zool.* **39** no. 4 pp. 294–299, 7 figs. Tring, 16th March 1936.

JORDAN (K.). **Some Siphonaptera from South America** [including 2 new species and 2 new subspecies].—*Novit. zool.* **39** no. 4 pp. 305–310, 8 figs. Tring, 16th March 1936.

EWING (H. E.). **A short Synopsis of the North American Species of the Mite Genus** *Dermanyssus* [including two new species and key].—*Proc. ent. Soc. Wash.* **38** no. 3 pp. 47–54, 1 fig. Washington, D.C., April 1936.

GOETGHEBUER (M.). **Les cératopogonides et les chironomides de Belgique au point de vue hydrobiologique.**—*Bull. Soc. ent. Belg.* **76** no. 1–2 pp. 69–76. Brussels, 25th February 1936.

As the various species of Chironomids and Ceratopogonids have definite preferences for different types of breeding places, the midge fauna of a given region is largely determined by the physical and biological conditions of the water present. Lists are given of the Ceratopogonids and Chironomids found in Belgium in water collections of different types.

VAZQUEZ (E. N.). **Algunos datos más sobre la leishmaniosis cutánea en el Levante de España.** [Some further Data on Dermal Leishmaniasis in the East of Spain.]—*Méd. Países cálidos* **9** no. 2 pp. 87–88. Madrid, February 1936.

Notes are given on one of a few cases of dermal leishmaniasis that occurred in Alicante on the east coast of Spain where sandflies (*Phlebotomus*) are abundant.

MULHEARN (C. R.). **Tick Fevers of Cattle in Queensland.**—*Qd agric. J.* **45** pt. 1 pp. 36–41, 2 refs. Brisbane, 1st January 1936.

In Queensland, cattle suffer from diseases caused by *Piroplasma bigeminum*, *Anaplasma marginale*, and *Piroplasma* (*Babesiella*) *argentinum* [*cf. R.A.E.*, B **24** 28], and also commonly harbour *Theileria mutans* [*cf.* **21** 283], all these blood parasites being transmitted by *Boophilus annulatus microplus*, Can. Brief notes are given on the biology of this tick. The economic importance of this group of diseases, the susceptibility of animals to infection, the symptoms produced, the methods of treatment and preventive inoculation are discussed.

GILTNER (L. T.) & SHAHAN (M. S.). **The present Status of infectious Equine Encephalomyelitis in the United States.**—*J. Amer. vet. med. Ass.* **88** no. 3 pp. 363–374, 7 refs. Chicago, Ill., March 1936.

Although there is reason to believe that equine encephalomyelitis has existed in the United States for some time, the discovery of the causal virus in California in 1930–31 led to a closer study of the disease, which has been widespread during the past few years. In 1935 little or no infection occurred in many of the regions that had suffered severely in 1930–34, whereas in others that had previously been uninfected or only lightly so, the losses were heavy.

The virus has been recovered from horses in 16 States. It was first found in several western States and later, in 1933, an exceptionally severe form was discovered in Maryland, Virginia, New Jersey and Delaware. The two viruses are serologically and immunologically distinct. With the exception of a small new centre of infection in North Carolina, the eastern virus appears to have remained almost entirely confined to the region where it was first observed, whereas the western one has spread eastward. Clinical reports strongly indicate the existence of the disease in at least 15 other States. The answers to a questionnaire show that in the east the cases begin to appear about the middle of July, become most abundant 4–6 weeks later and cease shortly after the beginning of severe frosts. In all but

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three States the disease has been reported not earlier than June nor later than late November. In the east infected areas are confined largely to the coastal and tidewater sections, where the land is low and intersected by tidewater inlets ; in other sections of the country they occur principally in land that is poorly drained, in irrigated areas, or where there are lakes, sluggish streams or bodies of stagnant water. Experimental evidence thus far obtained indicates that mosquitos are vectors of the disease [*R.A.E.*, B **21** 155 ; **22** 225 ; **23** 197 ; **24** 33], but it still remains to be proved that they are the only agents involved in natural transmission. The virus should be demonstrated in mosquitos caught in nature before it can be safely concluded that they act as vectors.

Further experiments with *Aëdes aegypti*, L., have been carried out in co-operation with F. Bishop and C. Smith. With a view to determining a practical means of testing mosquitos or other insects collected in the field for the presence of the virus, infected examples of *A. aegypti* were injected intradermally into the abdominal skin or the plantar pads of guineapigs. Apparently neither method will cause typical, easily recognisable disease in all guineapigs, but either or both means might be applicable under conditions where intracerebral implantation of filtrate is impractical. Feeding the mosquitos on normal guineapig blood immediately before killing and injecting them was not proved to be of particular advantage in such tests.

In studies on the transmission of an eastern strain of the virus, 11 groups, each comprised of 75–350 mosquitos, were infected by feeding them on guineapigs that had been inoculated with the virus by several methods 18–96 hours previously. Only one group produced the disease ; guineapigs subjected to bites on the 8th, 14th and 35th days following the infecting feed developed typical encephalomyelitis, whereas those exposed on the 21st, 28th and 52nd days remained uninfected, although on the 52nd day intradermal inoculation of some of the surviving mosquitos led to the infection and death of a guineapig. The infrequency with which the eastern virus is transmitted by this mosquito confirms the findings of others [*cf.* **22** 226 ; **24** 33]. On the other hand it readily, although not always regularly, transmitted the western virus. One of the experiments with the latter virus is described. A group of mosquitos was allowed to feed on the shaved abdomens of two guineapigs 44 hours after they had been inoculated in the plantar pads with the virus. Positive results were obtained in guineapigs exposed to mosquito bites at intervals of up to 74 days after the infecting feed (although in 3 the duration of the disease was protracted and the virus could not be demonstrated by passage to other guineapigs) but not after intervals of 83 or 92 days. A horse on which 110 mosquitos of the same group were fed 47 days after their infecting feed showed no symptoms of infection except that it was slightly less alert and less eager to feed about 5 days later, but the virus was demonstrated in its blood at intervals between the 96th and the 168th hour by subinoculation into normal guineapigs. In several experiments no evidence was obtained to indicate that the virus is transmitted hereditarily from one generation of *A. aegypti* to the next.

Such points as the presence of neutralising bodies in the serum of horses, the presence of virus in the blood of infected animals, possible means of infection other than by the bites of mosquitos, the susceptibility of various domestic and wild animals other than horses, and the employment of vaccine are also discussed.

ZUMPT (F.). **Beobachtungen über Mückenbrutplätze in der Tikoebene (Kamerun).** [Observations on Mosquito Breeding Places in the Tiko Plain, Kamerun.]—*Arch. Schiffs- u. Tropenhyg.* **40** no. 3 pp. 115–118. Leipzig, March 1936.

Mosquito breeding places in the Tiko plain (British Cameroons) are briefly described. Tree-holes were the chief breeding places of *Aëdes* spp. Anophelines were found especially in shallow rain-water puddles common on bad roads or among native huts. Puddles with green algae were those most favourable. Puddles of some size contained tadpoles, which soon cleared away the Anopheline larvae. Adult mosquitos were rare by day in the airy European houses, in the smoke-filled native huts and in animal quarters.

HOPKINS (G. H. E.). **Mosquitoes of the Ethiopian Region. I.—Larval Bionomics of Mosquitoes and Taxonomy of Culicine Larvae.**—Super roy. 8vo [8]+250 pp., 158 figs., 4 pp. refs. London, Brit. Mus. (N.H.), 1936.

The greater part (pp. 29–242) of this work on the larvae of mosquitos of the Ethiopian Region (which is here considered to include Aden and south-west Arabia, Madagascar and the adjacent small islands, and islands of the Gulf of Guinea) consists of descriptions of fourth-instar larvae of the species of Culicines (with a key to the genera) and notes on their breeding places and habits. In the first section (pp. 1–12), the classification of mosquito breeding places according to their characteristics is discussed, together with the processes of locomotion and respiration in the larvae. In the second (pp. 13–23), the morphology of the fourth-instar larva is described, with particular reference to structures used in identification and to modifications associated with habits or with certain types of breeding places. In the remaining section (pp. 24–28), notes are given on the technique of collecting, breeding, identifying and preserving larvae.

SICAULT (G.), MESSERLIN (A.), LUMMAU (J.) & FRITZ (J.). **Le paludisme dans le Rharb.**—*Bull. Inst. Hyg. Maroc* 1935 no. 1–2 pp. 5–91, 7 pls., 4 pp. refs. Rabat, 1935. [Recd. March 1936.]

A very detailed account is given of work on malaria and its control in the marshy plain of the Rharb (Morocco) from 1931 to 1934. Since 1933 measures against Anopheline larvae have been undertaken on a large scale. The commonest Anopheline is *Anopheles maculipennis* var. *sicaulti*, Roub. [*cf. R.A.E.*, B **23** 146]. The use of *Gambusia holbrooki* against mosquito larvae has already been described [**23** 147].

The following is taken from the summary of the section dealing with entomological studies. Among the Anophelines of the Rharb, one or perhaps several anthropophilous races of *A. maculipennis* Mg., are of importance. The anthropophilism is probably produced by the natural surroundings, since there are scarcely any shelters on the large windy plains except human habitations, wild animals are rare, and flocks live in the open. In the summer, however, the Anophelines are so abundant that they shelter among rushes, cactus, etc. The low density of the population explains the great distances covered by the mosquitos in search of food. Larvae of *A. maculipennis* are found during the winter but are then usually in the third or fourth instars, and oviposition seems to cease in most years between December or

January and March or April. During the cold months eggs are only laid in breeding places offering stable conditions of temperature and shelter, and ample nourishment. In the spring oviposition appears to be influenced by minimum temperature ; when this is constant in the neighbourhood of 8°C. [46·4°F.] eggs are found throughout the region. When the maximum winter and spring temperatures are high and the minimum temperatures vary widely from one week to the next, oviposition occurs throughout the winter, but the number of Anophelines produced is generally moderate. When the winter is cold, rainfall is high, and the minimum temperature remains below 8°C. for some time and then rises suddenly to 10–13°C. [50–55·4°F.], spring oviposition is retarded. Conditions are, however, favourable for development, the larval period is shortened, extensive breeding places have been created by the rains, and a considerable outbreak of Anophelines occurs. The high humidity that seems to be necessary for Anopheline activity prevails throughout the region. When the hot dry south-east winds lower the humidity, Anophelines seek shelter in houses and large numbers die. Violent rain storms destroy most of those sheltering in the open.

After discussing the epidemiology of the disease, the authors conclude that outbreaks are an indirect result of high rainfall (in a country where malaria is endemic), which, owing largely to the impermeability of the soil, increases the number and extent of breeding places and consequently the abundance of Anophelines.

The anti-larval work that has been carried out in various localities is outlined. It consisted chiefly of drainage and the application of oil or Paris green. In certain localities the measures were ineffective, partly because the zone treated was not sufficiently wide to prevent the invasion of the Anophelines, which have been found to fly three miles or more.

Sicault (G.). **Note sur l'épandage du vert de Paris per avion au Maroc.** —*Bull. Inst. Hyg. Maroc* 1935 no. 1–2 pp. 93–102, 2 pls. Rabat, 1935. [Recd. March 1936.]

Larvicidal fish cannot be established against Anopheline larvae in large areas of the extensive marshes in the Rharb district of Morocco because they dry up entirely in years when there is little rainfall. Oil cannot be used effectively in many cases because vegetation is abundant. Dusting with Paris green would give control, but at the edges of the marshes, the mud is too soft to walk on and the water is too shallow to allow the use of a boat. For these reasons, the experiments described were carried out in 1934 to determine the possibility of dusting by means of aeroplanes.

Preliminary laboratory experiments with dusts of Paris green and powdered stone in different proportions showed that one with 2 per cent. Paris green was as effective as others with 5, 10, 15 and 20 per cent. The stream of dust was regulated so that when the aeroplane was flown at a height of approximately 50–100 ft. on a still day the amount of dust was about 0·3 oz. per sq. yd. (a rate that is considered to be effective) over an area about 40 yds. wide. Even a slight breeze displaced the dust cloud considerably, and in this case a second journey was made along the edge of the marsh, the line of flight being altered to compensate for the degree of displacement of the dust cloud noted on the first journey. On 5th, 6th and 7th June, dust was applied by

aeroplane to marshes that had contained 8 larvae (all instars) per dip ; on 8th and 9th June no pupae and no larvae of the 3rd and 4th instars were found in the treated marshes, although there were a few 2nd instar larvae and quite a number in the 1st instar. The larval density in untreated marshes remained unchanged. The result was considered satisfactory, but as the average length of the larval period in Morocco is about 15 days, it was decided that dust should be applied at intervals of 10 days. Dusting was carried out in certain localities throughout the summer. In the area for which figures are given, the effectiveness of the treatment is shown by the sudden increase in the numbers of larvae after the dusting ceased. The actual effect on the transmission of malaria was difficult to estimate, particularly as it was not possible to begin dusting until after the emergence of the first generation of Anophelines, and as the populations of a number of villages had been subjected to prophylactic treatment. On the other hand both the native and European residents remarked on the great decrease in the numbers of adult mosquitos ; this was not, however, due entirely to dusting, for in a number of breeding places *Gambusia* had become sufficiently numerous by August for its action to be effective.

The cost of the dusting is discussed. It is slightly more expensive than oiling and must be carried out at shorter intervals. From August onwards a considerable economy was effected by using a finer mixture (Paris green with an impalpable powder), which dispersed over a wider area and affected 1st and 2nd instar larvae, which are unable to ingest large particles.

Morin (H. G. S.), Gaschen (H.) & Nguyen-Dinh-Hao. **Recherches sur le paludisme des voies d'accès au Plateau du Trân-Ninh.**—*Bull. Soc. méd.-chir. Indochine* **13** no. 9 pp. 1221–1246, 4 figs., 1 diagr. Hanoi, November 1935. [Recd. March 1936.]

Although in Indo-China regions of medium altitude would appear to be more malarious than low-lying land, regions higher than 2,000 ft. in Tonkin or 4,000 ft. in southern Annam are usually considered to be healthy, and *Anopheles minimus*, Theo., has not been found breeding in them. Malaria was, however, reported from the Plateau of Trân-Ninh, Laos, which lies at almost the same latitude as Tonkin, at an altitude of more than 3,000 ft., a military post at 4,900 ft. being particularly severely affected. A preliminary survey in January 1935 revealed the presence there of numerous larvae of *A. minimus*, which has never before been found actively breeding at such an altitude in Indo-China. On the other hand malaria was less severe at a village at 650 ft. Both these places are situated on the highway that runs from Phu-Diên (on the coast) to Xieng-Khouang, following the valley of the Song-Sa, which has for centuries been the natural means of access from Annam to the plateau.

In April 1935 a survey was begun at places along this route, and in the present paper a detailed account is given of the results of this and previous surveys, together with the measures recommended for the control of mosquito breeding in each locality. Malaria was everywhere severe, and malaria vectors were consistently present despite the change in altitude from 0 to 5,250 ft. Few regions offer such obvious proof of the importance of age-long movements of man in the distribution of a disease and of its vectors. The anti-malarial measures recommended are directed solely against the breeding places of

A. minimus, since this was the only species found infected and the only one of which the distribution coincided with the greatest intensity of malaria. *A. jeyporiensis*, James, which is an important vector in northern Indo-China, was taken almost everywhere, but in no case was it found to be infected. *A. culicifacies*, Giles, was not observed.

The region of Trân-ninh is rich in minerals and has a temperate climate, fertile soil and immense forests. Springs are numerous, and their drainage would enable water for drinking and irrigation to be supplied where it is needed and at the same time would eliminate the permanent collections of pure and semi-stagnant water that are the preferred breeding places of *A. minimus*. The elimination of malaria would probably accelerate immigration from the over-populated lowlands, which is, at present, often retarded by the lack of a good water supply. The following is the authors' summary of the measures recommended; they can be carried out with little expense and their effect is evident in a short time: The location during the dry season of all springs within a radius of ½ mile of the village to be protected; the construction of semi-permanent earth drainage canals with clean sides, straight, and free from grass; the shading of the drains by means of rapidly growing plants; the use of water-tight bamboo pipes to carry the water away from the main drain; the arrangement of special drinking places for cattle; and the protection of the whole course of the drainage canal from cattle, the trampling of which otherwise causes the sides to fall in and produces mosquito breeding places.

MARNEFFE (H.). **La moustiquaire en prophylaxie antipaludique. Son application à la protection des collectivités en Indochine.**—*Bull. Soc. méd.-chir. Indochine* **13** no. 9 pp. 1265–1297, 9 figs., 15 refs. Hanoi, November 1935. [Recd. March 1936.]

The advantages and disadvantages of mosquito nets and their value as a protection against malaria-carrying mosquitos are discussed, together with the possibility of designing one made of local material that would be effective and sufficiently cheap to be brought into general use among the natives of Indo-China. Information on methods of measuring the meshes of a material and on experiments to determine what sized mesh gives adequate protection and what effect nets of various kinds have on the circulation of the air is taken from the work of Russell and Nono [*cf. R.A.E.*, B **22** 146]. Recommendations are made on various points connected with the shape, method of hanging, etc. A cheap local material known as "tulle annamite," which is woven in the villages, would appear to be suitable for making the nets. A description is given of a design adapted to the habits of the natives, who sleep on thin straw mats instead of mattresses. In this type, which is commonly used in the Netherlands Indies, slots are made a short distance from the bottom edge of the net. Bamboo poles slipped into the slots rest on the framework of the bed and hold the net down tightly, any interstices being blocked up from the inside by means of the piece of netting left below the slots.

SIEBURGH (G.). **De malaria te Oosthaven.**—*Geneesk. Tijdschr. Ned.-Ind.* **76** no. 10 pp. 612–628, 2 pls., 2 maps. Batavia, 10th March 1936.

Endemic malaria is so serious at Oosthaven, a harbour in South Sumatra, that vessels leave it at sunset to return next morning.

Anopheline breeding places were surveyed at intervals between February and July 1935 and 324 larvae of *Anopheles sundaicus*, Rdnw. (*ludlowi* auct.), 233 of *A. vagus*, Dön., 69 of *A. barbirostris*, Wulp, and 27 of *A. aconitus*, Dön., were obtained. All the adults caught in dwellings were *A. sundaicus*, some of which were infected. It therefore appeared that this species, which breeds in brackish water, is the vector. An outline is given of the measures required, which consist in permanent reclamation and in the regulation of streams.

Strickland (C.) & Roy (D. N.). **Experimental malarial infection of** *Anopheles subpictus* **Grassi** (*A. rossi* **"type" Giles**).—*Geneesk. Tijdschr. Ned.-Ind.* **76** no. 7 pp. 387–393, 12 refs. Batavia, 18th February 1936.

In summarising data on the transmission of malaria by different species of *Anopheles* [*R.A.E.*, B **16** 41], Covell concluded that some of the records of infection in *A. subpictus*, Grassi (*rossi*, Giles) were equivocal. In any case its experimental rate of infection has been very low. Soesilo, however, in the Netherlands Indies, found an experimental infection rate of 80 per cent. in examples bred from both fresh and salt water [**17** 84]. As in 1933 the authors had ascertained for *A. stephensi*, List., in Calcutta the optimum conditions for the development of the infection [**21** 78], they subsequently made experiments with 221 examples of *A. subpictus* under the same conditions, using *Plasmodium vivax*, *P. malariae* and *P. falciparum*. The only infection obtained was with *P. falciparum* and consisted of zygotes in 2 and "black spores" in 4 out of 143 mosquitos dissected. Soesilo's results may, perhaps, be due to his having worked with a particularly susceptible variety of *A. subpictus*, which is the more likely in view of the recent division of *A. rossi*, Giles, into the typical form of *A. subpictus*, Grassi, and its varieties *indefinitus*, Ludl., and *malayensis*, Hacker. An alternative explanation would be that he used a parasite of unusually high virulence. Whatever the reason of the variations, however, it would appear that a problem is presented similar to that arising from the recent European research on the races of *A. maculipennis*, Mg., and that less attention will have to be paid to the morphology of a mosquito and more to its local infectivity.

Walch (E. W.) & Walch-Sorgdrager (G. B.). **Over de morphologische eigenschappen van verschillende** *subpictus* **eieren.** [On the morphological Characters of different *subpictus* Eggs.]—*Geneesk. Tijdschr. Ned.-Ind.* **76** no. 7 pp. 394–422, 3 pls., 5 diagr. Batavia, 18th February 1936. (With a Summary in English.)

Following previous studies of the eggs of Anophelines in the Netherlands Indies [*R.A.E.*, B **23** 233], the authors have made a very close examination of those laid by females of *Anopheles subpictus*, Grassi, obtained from various localities and give a detailed account of their results. They conclude that this species in the Netherlands Indies comprises at least two races, one breeding in salt water and the other in fresh water. The fresh water race may possibly consist of two forms with eggs having a coarse and a fine dorsal pattern respectively, but the differences, except those of the dorsal pattern, are slight. The eggs of females from Surabaja and Moeara Karang (both salt water areas)

showed only minute differences, but both fresh and salt water types were represented in batches laid by females from the fresh water zone of Batavia.

SOESILO (R.) & others. **Afdeeling malariabestrijding.** [Division of Malaria Control.]—*Meded. Dienst Volksgezondh. Ned.-Ind.* **24** no. 4 pp. 386–402. Batavia, 1935. (With a Summary in English.) [Recd. March 1936.]

This is a section of the Annual Report for 1934 of the Medical Laboratory of the Public Health Service of the Netherlands East Indies. The subjects dealt with include the control of Anopheline larvae in fresh water ponds for carp by introducing other fish [*R.A.E.*, B **21** 271], and investigations on the relation to malaria of *Anopheles leucosphyrus*, Dön., and *A. hyrcanus* var. *sinensis*, Wied. [**23** 20, 21, 253].

MARSHALL (J. F.) & STALEY (J.). **Exhibition of "Autogenous" and "Stenogamous" Characteristics by** *Theobaldia subochrea*, **Edwards (Diptera, Culicidae).**—*Nature* **137** no. 3466 pp. 580–581, 2 refs. London, 4th April 1936.

Larvae of *Theobaldia subochrea*, Edw., collected in Hampshire gave rise to 5 males and 1 female, which were confined in a cylinder with a capacity of 500 cc. The female, which had not been given a blood meal, deposited a raft of 153 eggs, of which all but 4 hatched within 4 days.

MAY (R. M.). **L'hexachloréthane dans la lutte contre les moustiques.**—*Rev. Path. vég.* **23** fasc. 1 pp. 5–19, 4 figs. Paris, 1936.

The disadvantages of the various methods of destroying mosquito larvae, such as oiling, the application of poisonous dusts, etc., are discussed. In experiments with several substances against adult mosquitos, hexachlorethane (C_2Cl_6) proved to be the most satisfactory, since it killed all those exposed to its vapours ; 4·3 mg. per 10 litres air killed them in 2½ hours and 70 mg. in 1½ hours. These doses are only effective in an enclosed space, a fact that will reduce the practical value of hexachlorethane in houses. The gas is not toxic to man or other mammals (rats). Pupae of *Aëdes* (*Ochlerotatus*) *communis*, DeG. (*nemorosus*, Mg.), in water exposed to air impregnated with the gas at concentrations of more than 4·3 mg. per 10 litres air were all dead at the end of 24 hours, but larvae in water on which crystals of hexachlorethane had been placed were not affected. It therefore appeared necessary to produce a continuous layer of the gas on the surface of the water with no interstices through which the larvae and pupae could breathe. For this purpose it was decided to mix the hexachlorethane with a finely divided inert dust, each particle of which, floating on the water, should be surrounded by a film of the toxic substance, which would subsequently vaporise. Talc was chosen because it is cheap and floats well. As pure C_2Cl_6 is difficult to reduce to a fine powder, it was dissolved in a slight excess of trichlorethylene, mixed with the talc, and the trichlorethylene removed by exposure to air. The dry mixture was ground up, sieved, and dusted on to water containing larvae and pupae of *Culex* and *Anopheles*. Experiments showed that the most satisfactory proportions were 2 parts C_2Cl_6 to 1 part talc, for although a

1 : 1 mixture killed the larvae, it did not kill the pupae, which can apparently project their siphons through the layer of gas if this is too thin. In the field, larvae and pupae of *Culex* were destroyed by the 2 : 1 mixture, but not by mixtures containing less hexachlorethane. Neither surface plants (*Lemna*) nor small crustaceans were damaged; the survival of the latter indicates that the water is not poisoned by the gas. It does not repel gravid female mosquitos as do oils. The day after the mixture had been applied at the rate of 1·4–1·7 oz. per sq. yd. no larvae or pupae were found, although *Culex* larvae had previously been abundant. In laboratory experiments both gold-fish and aquatic plants (*Myriophyllum* and *Fontinalis*) survived for at least 32 hours in water dusted with the mixture. The dust penetrates clumps of grasses and algae and does not render the water unsuitable for domestic purposes, watering vegetables, etc.

RAFFAELE (G.) & LEGA (G.). **L'anofelismo nella piana di Rieti.** [Anophelism in the Plain of Rieti.]—*Riv. Malariol.* **15** Sez. 1 no. 1 pp. 23–31, 4 figs., 1 map. Rome, 31st March 1936. (With a Summary in English.)

In the plain of Rieti, Umbria, malaria disappeared about 15 years ago and, though it was previously endemic, it seems never to have been very serious. Anophelines are abundant; in June 1935 it was easy to capture a thousand within arm's reach in an animal shed. During an investigation from May to October 1935, the only species observed was *Anopheles maculipennis*, Mg., the predominant race (over 90 per cent.) being var. *messeae*, Flni., with a few individuals of var. *melanoon*, Hackett, and of the typical form. Precipitin tests with 188 adults taken in houses showed that 22·3 per cent. had fed on cattle, 29·8 on cattle and man, 5 on man, 2 on horse, 6·3 on pig and 6·3 on sheep, while the remainder showed no reaction. Although some contact with man still persists, the region is typical of Anophelism without malaria.

BARBER (M. A.), RICE (J. B.) & VALAORAS (V. G.). **Decline of Malaria in a Region of East Macedonia owing to Diminished Rainfall.**—*Amer. J. Hyg.* **23** no. 2 pp. 298–328, 15 charts, 2 refs. Baltimore, Md, March 1936.

In this paper are given the results of a study of the decrease in malaria during 1932–35 in a region of eastern Macedonia. The decline dated from 1931, a year when transmission was high because heavy winter and spring rains had provided abundant water for the breeding of Anophelines throughout the summer. Such rains did not occur in the three subsequent years. Twenty-one villages in localities affected by drought were compared with six villages situated near a large river where, owing to the more permanent nature of the water collections, the breeding of Anophelines continued and a high incidence of malaria was maintained during the period of study. Spring and autumn malaria surveys were made in all years. The density of *Anopheles sacharovi*, Favr (*elutus*, Edw.), the chief vector of malaria in this region [*cf. R.A.E.*, B **24** 35], declined in the "dry" localities as a result of the decrease in rainfall and the drying up of its breeding

places ; and transmission, as measured by the parasite indices of infants, and the parasite, spleen, and morbidity indices of the population, was also reduced. There appeared to be nothing in the fluctuations of temperature that would account for the large variation in malaria transmission ; moreover, the temperature was similar in both groups of villages, which differed only in the amount of local water. *A. maculipennis*, Mg. (*typicus* and var. *messeae*, Flni.) was abundant, but its sporozoite index, which was only 0·13 in 1932, fell to almost nothing in 1934, when only one positive example was found among the 3,378 dissected during the year. *A. superpictus*, Grassi, the only other species that has been found infected in nature by the authors, was numerous in only a few of the villages, and the parasite index of children in these villages steadily declined with the decrease in the numbers of *A. sacharovi*. In general, the sporozoite index of *A. sacharovi* also declined. There is no evidence in this region of a cycle of malaria independent of the weather.

The work demonstrated that surveys, even when made at all seasons of the year, may fail to relate a local malaria incidence with the correct vector. A series of dry years may almost exterminate a vector from a village, while the parasite index, and to a greater degree the spleen index, remain fairly high. For example a survey in one particular village at any time during 1933 would have shown a high spleen index and a measurably high parasite index, and without a knowledge of the history of malaria in this village, transmission might have been attributed to *A. maculipennis*, the species then predominating. Actually the surveys for several years showed that the spleen and parasite indices were rapidly declining from a peak in 1931, a time when *A. sacharovi* was abundant. After 1932 the numbers of this species became insignificant.

The fact that a decrease in the density of *A. sacharovi* resulted in a diminution of malaria transmission should encourage attempts to reduce this mosquito by artificial means, more especially since it appears that transmission may almost cease in spite of the presence of small numbers of this species including a few infected individuals.

A further survey carried out in the autumn of 1935 showed that the incidence of malaria had increased in many of the villages, largely owing to heavy rains during the winter of 1934–35, which augmented the breeding places of *A. sacharovi*.

STROMQUIST (W. G.). **Malaria Control in the Tennessee Valley.**—*Civ. Engng* **5** no. 12 pp. 771–774, 3 charts. Easton, Pa, December 1935. [Recd April 1936.]

The author points out that the control of Anopheline mosquitos must be considered in the design and construction of dams as well as in their operation. Larvae of *Anopheles quadrimaculatus*, Say, which is the principal vector of malaria in the south-eastern part of the United States, are found in small ponds or in the shallow areas near the shores of artificial lakes. Conditions favourable to its breeding are a constant water level, accumulations of fine floating débris, aquatic or semi-aquatic vegetation affording protection, as little wave action as possible, and the absence of natural enemies. The basin of a reservoir should be cleared so that the surface and edges of the water will be free from vegetation, areas that would retain water

when the level of the reservoir is lowered should be drained, and larvicidal fish should be introduced. The dam should be designed to allow for adequate fluctuations in water level. The water, which should be kept at a maximum level during the winter and spring, should be lowered to normal level at the beginning of the mosquito breeding season (seasonal fluctuation), so that floatage will be stranded and the shore line freed from vegetation. During the breeding season (which is usually from July to September but may extend from May to October), the water should be lowered every 7–10 days (periodic fluctuation), so that larvae are stranded and die or are carried to open water where they are more exposed to natural enemies. This fluctuation also tends to discourage rank growth of aquatic vegetation. By this means the need for the application of larvicides, which is extremely expensive or even impossible, may be reduced or eliminated. The programme of construction should be so planned that the water is not impounded during the mosquito breeding season, for during the slow rising of the water through uncleared areas excessive numbers of Anophelines are produced despite the application of larvicides. If impounding is carried out in the autumn or winter, there is time for the floatage to collect and become stranded before breeding begins.

Details are given of the work that has been or is being carried out in the Tennessee River Valley on a series of dams for reservoirs that will have a total shore line of more than 2,300 miles, of which 1,600 miles is in an area where malaria is endemic. For the planning and application of control measures, malaria surveys should be carried out over an area within one mile of the reservoir (a mile being the approximate range of flight of the vector) both before and at intervals after the impounding of the water. An experiment on one reservoir in 1934 showed that effective control was maintained by a fluctuation of 1 foot every 10 days, that when the fluctuation was reduced to 6 inches the Anophelines increased, and that after the water was raised to its maximum level they became still more abundant despite the use of more than double the quantity of larvicides. In 1935, when the water was kept at a constant level, control was not obtained until vegetation had been removed from 30 miles of shore line so that the application of larvicides became effective. In this instance, when fluctuation was not employed, the cost of control during the season was more than doubled by the clearing and the additional application of larvicides. In another area, no examples of *A. quadrimaculatus* were found in 1934, but in the summer of 1935 they began to appear round a temporary pool formed a short distance above the dam by raising the level of the water. Catching stations were established, and it was found that the numbers increased until the water in the reservoir reached a level that could be controlled by the sluice gates. The periodic fluctuations that were subsequently maintained brought about a rapid and continuous decline in the production of mosquitos. At the same time their numbers increased in a slowly filling independent pool created by a small dam in one arm of the reservoir.

Before the dams were constructed, studies were made to determine whether, even with proper design and construction, fluctuations could be maintained without serious loss of head and efficiency in the operation of reservoirs for the production of power. It was found that by transferring the load from one dam to another, so that the reservoirs were alternately raised and lowered, adequate fluctuation could be maintained without interfering with the output.

Hall (D. G.). *Phlebotomus* (*Brumptomyia*) *diabolicus*, **a new Species of Biting Gnat from Texas (Diptera : Psychodidae).**—*Proc. ent. Soc. Wash.* **38** no. 2 pp. 27–29, 1 fig. Washington, D.C., 1936.

Lindquist (A. W.). **Notes on the Habits and Biology of a Sand Fly,** *Phlebotomus diabolicus* **Hall, in southwestern Texas (Diptera : Psychodidae).**—*T.c.* pp. 29–32, 2 figs., 2 refs.

In the first paper both sexes of *Phlebotomus diabolicus*, sp. n., are described from Texas, and a key is given to the males of the species of *Phlebotomus* occurring in north and central America. Of these only *P. vexator*, Coq., which feeds on amphibians and reptiles, has previously been recorded from the United States.

In the second paper an account is given of the feeding habits, life-history and seasonal prevalence of *P. diabolicus*, which is not an important pest but in south-western Texas frequently causes annoyance to man by its bites. The eggs are deposited singly or in clusters of 3–4 on the surface of the soil, as many as 40 being laid by one female. The egg, larval and pupal stages lasted 7–14, 16–27 and 5–9 days, respectively. Larvae were reared successfully on moistened soil, but died when placed on soil containing much organic matter or on rabbit or chicken faeces. They fed readily on the tissues of dead flies. Efforts to find the natural breeding places failed. The adults were present from May to November.

Papantonakis (E.). **Die Leishmaniosen in der Provinz Messinia (Peloponnes, Griechenland).**—*Arch. Schiffs- u. Tropenhyg.* **40** no. 4 pp. 141–146, 2 figs., 1 map, 4 refs. Leipzig, April 1936.

In June and July 1935, 20 localities in the province of Messenia, Greece, were visited and 135 human cases of visceral leishmaniasis, nearly all children from 2 to 3 years of age, and 85 dogs, of which 27 were infected, were examined. Most cases appeared in spring and early summer. On the assumption that sandflies are the vectors and that the disease has an incubation period of up to 6 months, this seasonal incidence agrees with the greatest abundance of *Phlebotomus* at the end of summer. Infection was found in most hill villages (300–1,500 ft. above sea-level) and not in villages in the plain. As dogs were abundant in both types of village, the distribution of various species of *Phlebotomus* is suggested as the reason for this local distribution. Of the 968 sandflies collected and identified, a large proportion (given as 270 in a table and 210 in a list) consisted of *P. major*, Ann., which is considered by Adler to be a vector in Greece [*R.A.E.*, B **23** 123]. Canine leishmaniasis occurred in all villages having human cases. Oriental sore was not found in Messenia.

Makara (G.). **The Breeding Places of** *Musca domestica* in **Hungary and the Fly Control.** [*In Magyar.*]—*Rep. Hung. agric. Exp. Sta.* **38** no. 5–6 pp. 286–291, 31 refs. Budapest, 1935. (With Summaries in German, French and English.) [Recd. March 1936.]

The literature on the breeding media and control of *Musca domestica*, L., is reviewed, and an account is given of investigations on farms in Hungary, which confirmed previous observations that pig dung is the preferred breeding medium of the fly in that country [*R.A.E.*, B **24** 44].

FRENEY (M. R.), MACKERRAS (I. M.) & MACKERRAS (M. J.). **Further Observations on Glycerine-Boric Acid Dressings for Fly-struck Sheep.**—*J. Coun. sci. industr. Res. Aust.* **9** no. 1 pp. 11–18. Melbourne, February 1936.

An account is given of further work in Australia on preparations of glycerine and boric acid for the treatment of blowfly strike on sheep [*cf.* *R.A.E.*, B **23** 292]. As the glyceroboric acid dressings were easiest to prepare, more tests were made with them ; the percentage by weight of boric acid in them was varied from 15 to 20·5. Of the preparations made with pure glycerine, the di-boric dressing continued to give the most satisfactory results ; it killed the maggots more quickly and apparently had a slightly more beneficial effect on the wounds. Preparations made from soap crude glycerine were less efficient ; the addition of water to glycerine greatly reduces its capacity for dissolving boric acid, and the fact that soap crude glycerine contains 7–8 per cent. water may partly explain its inefficiency. Dilution with absolute ethyl alcohol decidedly improves all dressings, whether made with pure or crude glycerine. It was found that dressings containing 25 per cent. by volume of alcohol had no deleterious effect on wounds, but that higher proportions caused swellings. When diluted with up to 25 per cent. alcohol, the dressings have a better consistency, penetrate more readily, and irritate the maggots so that they leave the wound more quickly ; their cleansing action on the wounds is greater and healing is more rapid ; moreover, they cost less. In consequence the pure di-boric preparation diluted with alcohol is superior to all others, and the diluted di-boric preparation made with crude glycerine is almost as effective as the undiluted pure preparation. The price of pure alcohol is prohibitive, but the alcohol diluted with 5 per cent. methyl alcohol, which can be bought under bond for manufacturing purposes, is satisfactory. Dressings made with 25 per cent. commercial methylated spirit caused swelling. Thus the dressing should either be obtained from a firm that can use the slightly denatured alcohol, or ordinary methylated spirit should be used in the proportion of 1 : 5 instead of 1 : 3. Even this lower proportion of methylated spirit may not always be satisfactory.

Sepsis interfered with the healing of wounds in about 16 per cent. of the cases, chiefly in sheep under one year old ; its occurrence did not bear any relation to the type of dressing used or to the extent of the infestation. Further attempts to produce re-strike [*cf. loc. cit.*] were never successful before the fourth week after treatment, and the strikes were then mild and limited in extent. After the sixth week the re-strike resembled a strike of average severity. There was no relation between the severity of the original strike or the dressing used and the extent and severity of the re-strike. On the whole the undiluted preparations gave better protection than the diluted ones. Tests indicate that the dressings may be of value as a preventive measure on stud ewes, and particularly on the heads of rams.

Entomological Investigations.—*Rep. Coun. sci. industr. Res. Aust.* **9** (1934–35) pp. 28–34. Canberra, 1936.

The work carried out in Australia by the Division of Economic Entomology during 1934–35 is reviewed ; certain of the investigations on the control of sheep blowflies have already been noticed from fuller accounts [*cf. R.A.E.*, B **23** 292, 294]. Recent work has shown

that *Lucilia cuprina*, Wied., the most important primary blowfly of sheep, is now widely distributed in Western Australia [*cf.* **22** 253]. It has also been found in northern Australia and in north-western Queensland. There is evidence that the extension to the more remote districts has been recent, and that it has been due partly to the distribution of fly-struck sheep and partly to natural dispersal. Studies on hibernation have shown that *L. sericata*, Mg., is better adapted to cold climates than *L. cuprina* and that both are better adapted than *Chrysomyia rufifacies*, Macq. Studies on nutrition have shown that the females require repeated meals of protein in order to continue to mature eggs throughout life ; this protein may be obtained from meat juice but not from moistened fleece. The findings of Hobson that certain bacteria synthesise accessory food factors necessary for the growth of maggots have been confirmed. The methods of producing experimental strike have been improved so that it is now possible to produce any number of strikes on any merino sheep at any time of the year. This work also supported the conclusions that the primary factor in susceptibility is the presence of free moisture in the fleece and on the skin, and that anatomical, physiological and pathological factors operate either by supplying the moisture, or by ensuring its retention long enough for the area to become attractive to the flies and for the maggots to become established, or by shortening the period for which the skin must remain wet. There is a direct relation between the number of eggs placed on an area and the probability that strike will develop, so that factors influencing attractiveness of sheep to the flies are of importance. The poisoning of carcasses as a means of reducing the abundance of blowflies may be usefully employed in open country where sheep are numerous and dead animals can be found without undue expense or difficulty. Experiments have shown that inefficient poisoning results in an increased emergence of primary flies ; that most poisons are not spread through the carcass by natural diffusion nor by primary maggots but by the secondary hairy maggots ; that thorough application of the poison to all parts of the carcass is necessary to prevent completely the emergence of blowflies ; and that sodium fluoride as a powder or sodium arsenite in solution are still the best substances known for treatment of carcasses.

Experiments on the transmission to cattle of *Anaplasma marginale* were completed [*cf.* **23** 198] and confirmed the conclusion that, under the conditions of the experiment, it was not transmitted by *Stomoxys calcitrans*, L., nor by *Tabanus circumdatus*, Wlk., nor by a needle used in such a way as to simulate the bites of these flies. It was, however, transmitted by needle when the punctures were deep and the interval between them was short.

An investigation has shown that *Lyperosia exigua*, de Meij., has not extended its range in Western Australia during the past four years [*cf.* **20** 85, 178].

Bhatia (H. L.). **The Rôle of *Tabanus orientis* Wlk. and *Stomoxys calcitrans* Linn. in the mechanical Transmission of Rinderpest.**—*Indian J. vet. Sci.* **5** pt. 1 pp. 2–22, 1 fig., 3 charts, 27 refs. Delhi, 1935. [Recd. March 1936.]

The experiments described were carried out at Muktesar, United Provinces, in 1934 to determine whether rinderpest could be transmitted

by the interrupted feeding of adults of *Stomoxys calcitrans*, L., or *Tabanus orientis*, Wlk. [*cf. R.A.E.*, B **14** 180; **15** 43, 76]. Flies that had partly engorged on bulls infected with rinderpest were allowed to complete their feed on healthy animals after intervals that varied from 30 minutes to 5 hours. The results of the four experiments with *S. calcitrans* and of three out of four with *T. orientis* were negative, but infection was obtained in an experiment in which 36 examples of *T. orientis* that had been starved for 21 hours and then partly fed on an infected animal were allowed to finish their feed on a healthy animal 5 hours later. In the other experiments the numbers of flies fed a second time varied from 6 to 14. The methods of keeping and feeding the flies are briefly described. In the case of *T. orientis* half of each wing was clipped before feeding to prevent them escaping. It was then possible to feed them on the back of the animal without enclosing them in tubes, they could be closely watched, and the necessity for throwing the animal was eliminated.

RAO (M. A. Narayan) & MUDALIAR (S. Vaidyanatha). **Some Observations on the Trypanosomes of Cattle in South India.**—*Indian J. vet. Sci.* **4** pt. 4 pp. 362–398, 3 pls. (1 col.), 6 figs., 35 refs. Delhi, 1935. [Recd. April 1936.]

The two types of trypanosomes found in the blood of cattle in southern India, a large one resembling *Trypanosoma theileri* and a smaller one resembling *T. evansi* [*cf. R.A.E.*, B **20** 12], are discussed from the literature and from the authors' own observations. Information on the mechanical transmission of the latter by Tabanids is reviewed. In May 1931 a collection of Tabanids was made in an area where cases of surra had occurred in horses earlier in the year. Flies were numerous, and within an hour more than 65 examples of *Tabanus striatus*, F., 5 of *T. ditaeniatus*, Macq., and 2 of *T. virgo*, Wied., together with a few of *Lyperosia* and *Stomoxys*, had been collected. Most of the examples of *T. striatus* were caught on the trunks of trees near which ponies and cattle were tethered. Thirty-five of the flies were dissected, and crithidia and their post-flagellate forms were found in the gut contents of 10 *T. striatus*. Attempts to transmit surra by feeding examples of *T. striatus* on laboratory animals or by injecting into them emulsions of *T. striatus* infected with crithidia gave negative results. Observations indicate that crithidia are usually present only in the digestive tracts of flies that have fed on blood, and blood would therefore appear to be necessary for their development. The possible sources of crithidial infection in flies is discussed. It has been suggested that surra might be contracted by animals eating, with grass, the eggs or larvae of Tabanids in which the infection was present in a latent state, but negative results were obtained when a pony and rats were fed on eggs of Tabanids collected from grass in a locality where outbreaks of the disease periodically occur.

Trypanosoma theileri was found in the blood of a bull from Madras. A study of cultures of it showed that the crithidial forms resembled *Crithidia tabani* found in Tabanids, but as the inoculation of calves with the crithidia from Tabanids had given negative results, the identity of the parasites could not be confirmed [*cf.* **5** 11; **15** 130].

Frost (S. W.). **A Summary of Insects attracted to liquid Baits.**—*Ent. News* **47** nos. 3–4 pp. 64–68, 89–92, 3 refs. Philadelphia, Pa, March–April 1936.

Tabanids were captured in relatively large numbers in the course of trapping experiments (testing various chemicals as baits) for the oriental fruit moth [*Cydia molesta*, Busck] in Pennsylvania during 1933 and 1934. Each trap contained 1 gm. or 1 cc. of chemical emulsified in a mixture of refiner's syrup and water (1–20). The species taken were *Tabanus lasiophthalmus*, Macq. (in May and June); *T. atratus*, F. (from 11th June to 13th September); *T. sulcifrons*, Macq. (in July and August); *T. giganteus*, DeG. (in late September and early October); and occasional individuals of *T. nigrescens*, P. de B., *T. lineola*, F., *T. costalis*, Wied., and *Chrysops*. About 75 per cent. of the captures were females. The most attractive chemicals seemed to be soap, sodium oleate, and camphoric and oleic acids.

Voris (R.). **The rapid Spread of an European Staphylinid in North America (Coleoptera, Staphylinidae).**—*Ann. ent. Soc. Amer.* **29** no. 1 pp. 78–80. Columbus, Ohio, March 1936.

Philonthus cruentatus, Gmel., which was probably introduced into the United States about 1900 in the refuse from cattle boats, had been found in 21 States as well as in Manitoba and Ontario by 1927. It is usually found in dung and farmyard refuse and is predacious on various species of flies.

Miller (Mrs. Newton). **Experimental Studies on** *Latrodectus mactans* **(The Black Widow).**—*J. Ent. Zool.* **27** no. 4 pp. 66–90, 4 figs., 8 refs. Claremont, Calif., December 1935. [Recd. April 1936.]

A detailed account is given of observations carried out in the San Joaquin Valley, California, over a period of 2½ years on the morphology and bionomics of *Latrodectus mactans*, F.

Gregson (J. D.). **The Production of Artificial Conditions conducive to Winter Feeding of Ticks** (*Dermacentor andersoni* **Stiles).**—*Proc. ent. Soc. B.C.* no. 32 pp. 6–7. Victoria, B.C., January 1936.

In experiments in British Columbia in 1934, 70 per cent. of the examples of *Dermacentor venustus*, Banks (*andersoni*, Stiles) placed on sheep during the summer engorged, the feed being completed in an average of 9–10 days. In the autumn, however, ticks placed on man, sheep and rabbits attached themselves and remained active but did not engorge. Their inability to feed was attributed to unfavourable physiological conditions present in them or their host at that time of year. In an endeavour to produce normal spring conditions in the host, a rabbit was subjected to 7 hours of light a day for a week beginning on 14th December, after which the amount of light was increased by 10 minutes a day. At the end of a month a tick was placed on the rabbit; it attached itself immediately and engorged in a fortnight. Two other ticks also engorged, including one that had failed to engorge on man in November. Finally, a tick was placed on an untreated

rabbit and attached itself. It was removed at the end of 5 days, unengorged but active, and placed under a dark capsule on the rabbit, which was exposed to continued light treatment. Water baths shielded the tick from the heat generated by the electric light. By the fourth day it had permanently attached itself and was engorging.

SPENCER (G. J.). **A Check List of the Fleas of British Columbia with a Note on Fleas in Relation to Sawdust in Homes.**—*Proc. ent. Soc. B.C.* no. 32 pp. 11–17. Victoria, B.C., January 1936.

A list is given of 61 species and varieties of fleas taken on various birds and mammals in British Columbia, with general notes on their host relations. They include *Pulex irritans*, L., which was apparently first recorded from this Province 27 years ago [*cf. R.A.E.*, B **24** 43]; as it is still of only sporadic occurrence, the danger of its becoming a pest is remote.

Recently there have been numerous reports of outbreaks of fleas in Vancouver, and as with one exception they have occurred in houses where sawdust burners have been installed, there would appear to be some connection between the two. In most cases, where the cats and dogs sleep in the basement, they make their beds in the sawdust and their fleas become very abundant. In other instances, the fleas would appear to have been imported with the sawdust, in which stray animals had probably slept before it was delivered. The species of fleas have not been identified. In order to test the ability of fleas to survive in various materials, eggs of *Ctenocephalides felis*, Bch., were placed on mixtures of various substances, including sawdust, dust and rubbish of various kinds, and excreta of fleas. In the jar containing dried blood excreted by fleas and débris from animals' beds above damp sawdust, all the eggs hatched and an enormous number of adult fleas were obtained 31 days after oviposition. No adults were produced in the other jars, although in some the larvae lived until they were almost mature. No development took place on cedar sawdust.

MAZZA (S.) & others. **Investigaciones sobre la enfermedad de Chagas. I–VI.** [Investigations on Chagas' Disease. I–VI.]—*Publ. Misión Estud. Pat. reg. argent. Jujuy* no. 26, 39 pp., 21 figs., 20 refs. Buenos Aires, 1936.

Papers in this series record cases of Chagas' disease in man in various parts of Argentina. *Triatoma infestans*, Klug, infected with *Trypanosoma* (*Schizotrypanum*) *cruzi* was found in the province of Buenos Aires at 41° S. Lat., this being the most southern limit ascertained for Argentina. *T. rosenbuschi*, sp. n., which is described in English, German, Latin and Spanish by Mazza from the Rio Negro territory and is closely allied to *T. platensis*, Neiva, was found to be heavily infected with the metacyclic form of *T. cruzi*, mice being infected by injection of its excreta. *T. infestans*, *Eutriatoma* (*T.*) *oswaldoi*, Neiva & Pinto, and *T. rosenbuschi* are the three species known to be infected in nature in Argentina. Cats infected with *T. cruzi* occurred in dwellings in which were infected examples of *T. infestans* in the Rio Negro territory and in Bahía Blanca. *T. platensis* was found in various districts, but never infected with *T. cruzi*.

[SHUB (G. M.) & NIKOLAEV (B. P.)] **Шуб (Г.М.) и Николаев (Б. П.). Malaria in Karelia.** [*In Russian.*]—*Med. Parasit.* **4** no. 6 pp. 475–480, 1 map, 2 refs. Moscow, 1935. (With a Summary in French.) [Recd. April 1936.]

Locally acquired malaria does not appear to have been observed in southern Karelia prior to 1932, but since then the number of cases has been increasing and 300 were recorded in the first half of 1935. The disease has evidently been introduced by workmen brought from malarious parts of Russia. In a survey carried out in July 1935 in the region of the lake of Onega, *Anopheles maculipennis*, Mg., was found to be widely distributed. Of the eggs laid by females captured in the field and brought to Leningrad the majority belonged to race *messeae*, Flni., and only two batches were those of typical *maculipennis*. There are probably two generations a year, of which only the first appears to be of epidemiological importance, the adults apparently emerging at the end of June and beginning of July. Larvae of the second generation appeared in mid-July. The mean temperature in July allows *Plasmodium vivax* to complete its development in the mosquitos in 4–5 weeks. Oöcysts were found in one female of several caught on 22nd July in a room occupied by workmen of whom one had malaria. The adult mosquitos occurred in inhabited houses, animal quarters and latrines, and the larvae in bays of the lake, in rivers along shallow banks covered with vegetation and sheltered from the wave action by pieces of timber, and in ponds, ditches, swamps, etc. Karelia is a centre of the timber industry, and the rafting of logs creates close contact between man and mosquito, but as malaria is as yet not severe and the Anopheline breeding places are very extensive, measures for control should be directed to the elimination of infection in man. They should include the registration and treatment of all infected persons arriving in Karelia, and the compulsory use of mosquito nets by all who have malaria in summer.

[VELICHKEVICH (A. I.).] **Величкевич (А. И.). New Data on the Biology of *Anopheles* and on the Epidemiology of Malaria in the southern Coast of the Crimea.** [*In Russian.*]—*Med. Parasit.* **4** no. 6 pp. 481–485. Moscow, 1935. [Recd. April 1936.]

Further observations on the bionomics of Anophelines on the southern coast of the Crimea [*cf. R.A.E.*, B **21** 7], which were continued up to 1935, showed that larvae of *Anopheles maculipennis*, Mg., can thrive in water containing a moderate amount of decaying matter, provided that green unicellular organisms are present to purify the water by photosynthesis. Eggs and larvae occurred during 8–10 months, depending on the meteorological conditions of the year. If the winter was severe, oviposition was retarded until the end of April or beginning of May, but if the weather was warm, eggs were found as early as March, and the first pupae about mid-April. Adult activity usually continued till about mid-December, and over 7 generations could be produced in a year. No typical hibernation quarters were found ; females occurred in houses, cellars and caves during frosts, but abandoned them as soon as it became warmer.

As a result of warm winters and damp summers and of the increased cultivation of tobacco, *A. claviger*, Mg. (*bifurcatus*, auct.) has become

more abundant, the larvae being found even in the hot summer months. In the autumn they usually occur in open water reservoirs exposed to the sun on the slopes of mountains or in tobacco plantations devoid of trees, though they also thrive in waters in dark caves, etc. As a rule, they are found in water containing diatomaceous algae, unicellular flagellates, infusoria, etc., with little decaying matter. They find optimum conditions from autumn to May in cement and stone wells and reservoirs, sheets of flood water, and water in tunnels and mountain caves entirely devoid of light but comparatively warm in winter. They occurred in wells in water that smelt of hydrogen sulphide and contained decaying plants, but not in reservoirs of pure water covered with *Chara* spp., though in the summer these became infested with *A. maculipennis*. Larvae about to pupate were found about the end of December, and the adults began to emerge on 9th February at a water temperature of 6–10°C. [42·8–50°F.] and up to 20°C. [68°F.] in the sun. Sudden frost temporarily interrupted emergence. If the weather was snowy and cold, pupation and emergence only began about mid-April. When the water temperature fell to 4–0°C. [39·2–32°F.], larvae of the fourth instar became inactive and sank to the bottom. The larvae were usually killed if the water froze, but if this happened once only and for a short period, 1–5 per cent survived. The pupae were less resistant. The larvae usually keep in the shade or diffused light, even in winter. Since the breeding places of *A. claviger* are always near dwellings and the mass emergence of the adults takes place from March to May, they may be of importance in the increase of malaria in May, when the mean temperature (18°C. [64·4°F.]) is favourable for the extrinsic cycle of *Plasmodium*.

A. plumbeus, Steph., breeds in holes in trees, in which the winter temperature of the water is usually 1–2°C. [33·8–34·6°F.]. Eggs and larvae of all instars hibernate. In completely frozen water large numbers of the larvae freeze on the surface of the ice, where they are warmed as soon as the sun appears. They also develop in water smelling of hydrogen sulphide and in the presence of the larvae of the Syrphid, *Myathropa*. Other mosquito larvae sometimes associated with them in the tree holes are *Aëdes geniculatus*, Ol., *A. pulchritarsis*, Rond., *Orthopodomyia pulchripalpis*, Rond., and *Culex*.

As a result of oiling, cleaning or draining of various accumulations of water, improvements in the method of irrigating tobacco, and the introduction of *Gambusia* into all districts in southern Crimea, the percentage of potential breeding places actually infested in the eastern part of the area, where the highest incidence of malaria occurred, dropped from 55 in 1929 to 36 in 1930 and 4·4 in 1934.

[Nabokov (V. A.) & Tiburskaya (N. A.).] **Набоков (В. А.) и Тибурская (Н. А.). On the Use of Pyrethrum in Insect Control.** [*In Russian.*]—*Med. Parasit.* **4** no. 6 pp. 486–491, 8 figs. Moscow, 1935. [Recd. April 1936.]

In 1932 a pyrethrum spray known as " Flicide," which consists of a 10 per cent. benzene extract of pyrethrum with the addition of phenyl and methyl salicylates, gave excellent results against Anophelines in day-time shelters in peat bogs near Moscow when applied at the rate of 10 fl. oz. per 1,000 cu. ft. In view of this, the action of the spray was tested on *Musca domestica*, L., which was found to be more resistant than mosquitos, in order to find if a smaller rate of application

would be effective. The flies were sprayed in a gas chamber at 19–26°C. [66·2–78·8°F.], and after 30 minutes the percentages that were still flying and that flew up from the floor when lightly swept were estimated. The flies were then transferred into a glass bell-jar and the mortality ascertained after 24 hours. It was found that 7–8 fl. oz. per 1,000 cu. ft. brought down all the flies in 30 minutes, and prevented them from flying when swept up, though 15 per cent. were alive after 24 hours. This rate of application would therefore give complete control if the flies were swept up and destroyed after 30–40 minutes. At the rate of 10 fl. oz. the spray killed 99 per cent. of the flies.

Flies placed in a net fixed to the ceiling of the chamber were not affected by the spray, which shows that the volatile substances in it are not toxic and that its action depends on contact of the pyrethrins with the insects.

To ascertain the duration of the effectiveness of the pyrethrins after evaporation of the benzene, flies were placed under glass bell-jars in which the spray had been released 24 hours previously and which had been left uncovered until all the benzene had evaporated. After 30 minutes all the insects were unable to fly, and in 24 hours 98 per cent. were dead, whereas all remained alive in a control bell-jar.

Descriptions are given of equipment for the application of the spray, and it is pointed out that it would be well to find a solvent that would ignite less readily and smell less than benzene.

[Bogoyavlenskiĭ] Bogojawlenski (N .A.). **Ueber friedliches Zusammenleben von Gambusien und** *Anopheles*-**Larven in der Natur.** [Failure of *Gambusia* to destroy *Anopheles* Larvae in Nature.]—*Arch. Schiffs- u. Tropenhyg.* **40** no. 5 pp. 201–203. Leipzig, May 1936.

In the Lenkoran district (the most southern part of Russian Azerbaijan), the malarial season is in autumn, *Plasmodium falciparum* predominating. The Anophelines found are *Anopheles maculipennis*, Mg., *A. hyrcanus*, Pall., *A. superpictus*, Grassi, *A. pulcherrimus*, Theo., and *A. claviger*, Mg. (*bifurcatus*, auct.), the first-named being the chief vector. In the marshy areas Anopheline breeding places abound, although *Gambusia* can be found in them and has been permanently established in the marshes. A close association of Anopheline larvae and *Gambusia* was observed in various localities, but the larvae were not destroyed, partly because of a great profusion of water plants, which afforded mechanical protection for them and plentiful food for the fish. *Potamogeton crispus* grew so densely that it was difficult to force a boat through it. In the conditions obtaining in Lenkoran *Gambusia* cannot be depended upon for control.

Alain (—), Cavalade (—), Ginieys (—) & Rougé (—). **Rapport sur le voyage d'études malariologiques effectué en Italie sous les auspices de la S. D. N.**—*Ann. Méd. Pharm. colon.* **34** no. 1 pp. 59–74. Paris, 1936.

The authors, who attended the international course in malariology in Rome in 1935, give an account of the campaign against malaria that is being carried out in Italy, showing the Anophelines concerned, the measures used, and the results obtained.

Earle (W. C.), Palacios (L. D.) & Arbona (A.). **Methods used to Control Malaria in Puerto Rico.**—*Puerto Rico J. publ. Hlth.* **11** no. 3 pp. 434–456, 6 figs., 3 refs. San Juan, P.R., March 1936. (With translation in Spanish pp. 456–478.)

The important vector of malaria in Porto Rico is *Anopheles albimanus*, Wied., which breeds in almost any natural water collection not too densely covered by vegetation [*cf. R.A.E.*, B **18** 232]. The breeding areas may be classified as those in the lowlands below or at sea level, which are often swampy and covered by mangroves; those in rivers, streams, ravines and main drainage channels; those in higher lands with impervious soils where pools of water collect in the rainy months, or in higher lands with pervious soils but a high water-table from which seepage occurs; and those in irrigated sugar-cane land. Most of the breeding areas can be eradicated by drainage [*cf. loc. cit.*], and this paper deals chiefly with the various methods that have been found to be most satisfactory. The use of Paris green on areas that cannot be economically drained is briefly discussed.

Lewthwaite (R.) & Savoor (S. R.). **Recent Work on the Typhus-like Fevers of Malaya.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 6 pp. 561–571, 16 refs. London, 8th April 1936.

A summary is given of recent work on the three fevers of the typhus group that occur in Malaya, urban and rural typhus and tsutsugamushi disease, which has been made possible by the establishment of strains of these diseases in laboratory animals. Tsutsugamushi disease and rural typhus are referred to as separate entities on account of the clinical distinction in human cases, an initial ulcer and bubo occurring in the former and not in the latter. The rickettsiae demonstrated in these two diseases are identical in morphology, distribution and staining characteristics with *Rickettsia orientalis* [*cf. R.A.E.*, B **19** 160], whereas in these respects those of urban typhus resemble *R. prowazeki*. Complete cross-immunity exists between strains of rural typhus and tsutsugamushi disease but is absent between these infections and urban typhus or Rocky Mountain spotted fever. A comparison of urban typhus and Rocky Mountain spotted fever showed that when the second inoculum is the virus of the latter there is no cross immunity, but when it is the former there appears to be a definite, though incomplete, cross immunity. The entomological investigations have already been noticed from a more detailed source [*cf.* **24** 29], but a more recent attempt to transmit the virus of rural typhus by means of *Xenopsylla cheopis*, Roths., using a modified method, gave results suggesting that this flea may occasionally transmit the virus. Additional evidence that the rat is the reservoir was obtained by maintaining the virus in rats for 21 passages without loss of virulence and by recovering strains of tropical typhus from 2 out of 23 wild rats trapped in areas where human cases of disease had occurred.

Wilson (D. B.). **Rural Hyper-endemic Malaria in Tanganyika Territory.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 6 pp. 583–618, 10 charts, 25 refs. London, 8th April 1936.

A detailed account is given of a study undertaken in Tanganyika Territory in 1933–34 to obtain more exact information on the incidence and course of malarial infection in an African (Bantu) population living in a hyper-endemic area, to determine the events that underlie the commonly accepted indices of malarial intensity, namely spleen and

parasite rates, in order to establish a standard by which other communities may be judged, and to estimate the degree of disability likely to ensue from such infection.

In the course of the work, data were collected on the vector, its prevalence and infectivity. Anopheline larvae were found in pools in a river bed, particularly in the dry season before the river had dried up completely, but the most important breeding places, both during and after the rains, were the rain-water pools where *Anopheles gambiae*, Giles, predominates. *A. funestus*, Giles, and *A. coustani*, Lav., were taken in shade in both types of pool but were not common; *A. squamosus*, Theo., was taken mainly at the edges of rain pools and always in light shade. Only *A. gambiae* and *A. funestus* were taken in the huts, the proportion being 20 to 1. In 2,087 searches carried out between August 1933 and November 1934, the average number of Anophelines per hut was 5·6 (1·1 males and 4·5 females). Mud huts (average 6·2) seem to be more attractive than those with palm-leaf walls (average 5·0), probably because the latter afford less perfect shelter and are lighter and drier. The number of females per house varied during the months of 1934 from 0·6 to 14·9, the largest numbers occurring in June–August. When selected huts were searched until no more mosquitos could be found, almost twice as many mosquitos were caught as in the regular searches, so that the true house infestation would be at least twice the figures given. The sporozoite rate in the mosquitos dissected was 12·2 per cent. The numbers of Anophelines and the proportion infected increase after the onset of the rains, and even a transient replenishment of the rain pools causes a rise in numbers and an increase in infectivity. The rise in mosquito infectivity is not due to a rise in human infectivity, which follows rather than precedes it. It appears that there must be some biological difference in the parasite-vector complex that depends on rainfall and causes or permits a more rapid and more certain development of sporozoites. The maximum sporozoite rate of 24 per cent. occurred in July 1934, when the average infestation was 14·9 mosquitos per hut. The probable number of infected Anophelines per hut would be 7, and assuming that a female bites every fourth night and that there are 3·5 persons per hut, each person was likely to receive an infecting bite every other night. On the other hand, at the end of the dry weather, the chance of an infecting bite was only 1 in 300 on any one night. The Anophelines also bite out of doors. It is concluded that transmission is due to *A. gambiae*, which is dependent on rain for its breeding places and for acquiring its maximum infectivity, that the locus of infection is in or near houses, and that any measures of personal protection that would be adaptable to these scantily-clad natives would be quite inadequate to protect them from frequent infection for at least 3–4 months in the year.

HOARE (C. A.). **Morphological and Taxonomic Studies on Mammalian Trypanosomes. I. The Method of Reproduction in its Bearing upon the Classification, with special Reference to the *lewisi* Group.**—*Parasitology* **28** no. 1 pp. 98–109, 1 fig., 18 refs. Cambridge, 27th January 1936. **II.** *Trypanosoma simiae* **and Acute Porcine Trypanosomiasis in Tropical Africa.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 6 pp. 619–645, 2 figs., 1 map, 2 pp. refs. London, 8th April 1936.

The first paper is devoted to a critical analysis and revision of the systematics of the mammalian trypanosomes, and it includes a method

of classification that is an amplification of one previously suggested [*cf. R.A.E.*, B **21** 162]. It is shown that there is no justification for the recognition of more than one genus, *Trypanosoma*, and *Schizotrypanum* (of which *S. cruzi* is the type) therefore becomes a synonym.

In the second paper the author discusses at length the identity of the trypanosome causing acute, rapidly fatal trypanosomiasis of domestic pigs in tropical Africa. [*cf.* **9** 58; **16** 36; **23** 185]. From examination of blood films from infected pigs and from a critical analysis of accounts of outbreaks, he concludes that it is *Trypanosoma simiae* [*cf.* **2** 156]. This trypanosome was originally described as monomorphic but is in reality polymorphic, and *T. rodhaini* [*cf.* **16** 36] must be considered a synonym of it. Out of 180 animals examined by Bruce [*cf.* **1** 100] only the wart-hog (*Phacochoerus aethiopicus*) harboured *T. simiae*. From this and other evidence it would appear that outbreaks of acute porcine trypanosomiasis are probably due to the transmission of *T. simiae* from wart-hog to domestic pigs by *Glossina* [*cf.* **1** 134; **2** 185] and its mechanical spread through the herd by other blood-sucking flies [*cf.* **16** 36; **23** 185].

Ellison (F. O'B.). **Malaria Epidemics and Sun-spot Cycles.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 6 pp. 659–665, 1 diagr., 6 refs. London, 8th April 1936.

The author discusses the nature of sun-spots and their possible relation to meteorological phenomena in connection with Gill's suggestion that periodicity in malaria epidemics may be associated with periods of minimum and maximum sun-spot numbers [*R.A.E.*, B **24** 118]. He concludes that the relation between the two is not so close as Gill suggests, either in Ceylon or elsewhere. Although the last two outbreaks of malaria in Ceylon, in 1928 and 1934, coincided with a minimum and a maximum number of sun-spots, from 1923 back to 1905 epidemics both in Ceylon and elsewhere (taking Gill's dates with one or two necessary corrections) have prevailed during one and a half complete sun-spot cycles at the times of maximum and minimum numbers and at every stage between. The suggestion of an indirect effect through changes in rainfall cannot be maintained in Ceylon because variation in the rainfall in most places does not follow the sun-spot cycle; where it apparently does so, the effect is too small to influence the breeding of Anophelines. Finally there is a grave doubt whether the measured changes in the solar constant can be the cause of the weather changes attributed to them.

Regendanz (P.) & Muniz (J.). **O *Rhipicephalus sanguineus* como transmissor da Piroplasmose canina no Brasil.** [*R. sanguineus* as a Vector of Canine Piroplasmosis in Brazil.]—*Mem. Inst. Osw. Cruz.* **31** fasc. 1 pp. 81–84, 9 refs. Rio de Janeiro, 1936.

Though piroplasmosis is very common in dogs throughout Brazil, its vector there has hitheto been unknown. Dogs in Rio de Janeiro are very often parasitised by *Rhipicephalus sanguineus*, Latr., and in August 1934 females taken from a dog were kept for oviposition. The resultant larvae were fed on a guineapig and transformed into nymphs, and in the salivary glands of one of these were numerous piroplasms morphologically similar to those in the salivary glands of

Dermacentor reticulatus, F., infected with *Piroplasma* (*Babesia*) *canis* [*R.A.E.*, B **21** 76]. Some adults from the same batch of nymphs were placed in December 1934 on a non-infected dog, which subsequently died, numerous piroplasms being found in its blood. As a result of this and of another experiment in 1935, it is concluded that *R. sanguineus* is a vector, though perhaps not the only one in Rio de Janeiro.

Papers noticed by Title only.

SMART (J.). **Larvae of *Lucilia sericata* Mg., from a Case of aural Myiasis reported from Essex (Diptera).**—*Proc. R. ent. Soc. Lond.* (A) **11** pt. 1–2 p. 1. London, 31st March 1936.

PAGAST (F.). **Ueber Bau und Funktion der Analpapillen bei *Aëdes aegypti* L. (*fasciatus* Fabr).** [On the Structure and Function of the Anal Papillae in *A. aegypti*.]—*Zool. Jb.* Allg. Zool. **56** no. 2 pp. 183–218, 2 pls., 6 figs., 32 refs. Jena, 8th April 1936.

[PAVLOVSKIĬ (E. N.).] **Павловский (Е. Н.). Methods of Studying blood-sucking Mosquitos (Culicidae). 2nd revd. & enl. Edn.** [*In Russian.*]—Demy 8vo, 176 pp., 77 figs., 6 pp. refs. Moscow, Izd. Akad. Nauk SSSR, 1935. Price 5 *rub.* [*Cf. R.A.E.*, B **14** 67; **15** 96.] [Recd. March 1936.]

PRADO (A.). **Observações sôbre os mosquitos que se criam nos entrenós das taquaras.** [Observations on Mosquitos breeding in the Internodes of graminaceous Plants (in Brazil).]—*Bol. biol.* (N.S.) **2** no. 2 pp. 39–41, 1 fig. S. Paulo, December 1934. [Recd. April 1936.]

DA FONSECA (F.). **Notas de acareologia. XV. Ocorrência de uma nova sub-espécie de *Ixodes ricinus* (L., 1758) no estado de S. Paulo (Acarina, Ixodidae).** [A new Subspecies of *I. ricinus* (*aragãoi* from a deer, *Mazama simplicicornis*) in S. Paulo, Brazil.]—*Bol. biol.* (N.S.) **2** no. 2 pp. 31–34, 2 figs. S. Paulo, December 1934. [Recd. April 1936.] [See *R.A.E.*, B **24** 1.]

ARTIGAS (P.) & UNTI (O.). **Sôbre a presença de *Ctenocephalides canis* (Curtis, 1896), em Curitiba.** [On the Presence of *C. canis* in Curitiba, Brazil.]—*Bol. biol.* (N.S.) **2** no. 2 pp. 34–38, 5 figs., 4 refs. S. Paulo, December 1934. [Recd. April 1936.]

WAGNER (J.). **Ueber die Aphanipterenfauna der Maulwurfsnester.** [On the Flea Fauna of Moles' Nests (in Austria).]—*Konowia* **15** no. 1–2 pp. 97–101, 1 fig. Vienna, 1st April 1936.

ARGYROPULO (A. I.). **Zwei neue Aphanipteren-Arten aus Transkaukasien.** [Two new Fleas from the nests of *Microtus arvalis* in Transcaucasia.]—*Konowia* **15** no. 1–2 pp. 145–151, 4 figs. Vienna, 1st April 1936.

[PAVLOVSKIĬ (E. N.).] **Павловский (Е. Н.). Insects and Ticks—Transmitters of filterable Viruses** [a review of the literature]. [*In Russian.*]—*Priroda* **24** no. 12 pp. 54–64, 1 ref. Leningrad, 1935. [Recd. March 1936.]

SIMMONS (J. S.). *Anopheles (Anopheles) punctimacula* **naturally infected with Malaria Plasmodia.**—*Amer. J. trop. Med.* **16** no. 2 pp. 105–108, 7 refs. Baltimore, Md, March 1936. *Anopheles* **experimentally infected with Malaria Plasmodia.**—*Science* **83** no. 2150 pp. 268–269, 1 ref. New York, 13th March 1936.

As a part of a general study of the malaria situation at Fort Sherman, Panama Canal Zone (where the incidence of the disease has always been unusually high), routine dissections were made from August 1935 of mosquitos collected each week in sleeping quarters. Negative results were obtained with 101 examples of *Anopheles albimanus*, Wied., and 1 of *A. pseudopunctipennis*, Theo., but 1 out of 6 of *A. punctimacula*, D. & K. (*strigimacula*, D. & K.), contained 5 oöcysts of moderate size, in all of which were sporozoites. It was noted that one oöcyst had ruptured and released many sporozoites into the surrounding fluid, although no sporozoites were found in the tissues of the salivary glands, which were torn during dissection. This observation is of particular interest as this Anopheline has been considered, on rather meagre negative evidence, not to be susceptible to infection with *Plasmodium* [*cf. R.A.E.*, B **17** 109]. On the other hand it has been suggested that it is the vector of malaria on the coast of Salvador [**11** 167]. D. P. Curry [**19** 141] states that it breeds in Panama in shaded ground pools in the jungle and suggests that reports from other countries indicating that it breeds in open pools rich in algae [*cf.* **11** 167] may have been due to confusion with *A. neomaculipalpus*, Curry. It flies for long distances, and except at the end of the dry season, it is not uncommon on both the Atlantic and Pacific side of the Isthmus. During the autumn of 1935 it was the most prevalent Anopheline caught in dwellings in the region of Fort Sherman, and a large proportion of the specimens were engorged. Further investigations may show that other members of the *Arribalzagia* group, including *A. apicimacula*, D. & K., and *A. neomaculipalpus*, are vectors of malaria.

In the second paper it is reported that in experiments carried out in February 1936 laboratory-bred examples of *A. punctimacula* were found to be susceptible to infection with *Plasmodium vivax* or *P. falciparum* when fed on the blood of suitable malaria patients.

BOYD (M. F.), STRATMAN-THOMAS (W. K.) & KITCHEN (S. F.). **On the Duration of Infectiousness in Anophelines harbouring** *Plasmodium falciparum*.—*Amer. J. trop. Med.* **16** no. 2 pp. 157–158, 1 ref. Baltimore, Md., March 1936.

The results of attempts to infect man with malaria by the bites of Anophelines have been distinctly less certain with *Plasmodium falciparum* than with *P. vivax*, although in each case the presence of sporozoites in the salivary glands of the mosquitos was verified after they had fed. Failure cannot be attributed to immunity in the patients, since these were subsequently infected by using other mosquitos (usually infected with the same strain of the parasite). Analysis of experimental data according to the time that elapsed between the end of the extrinsic incubation period and the employment of the mosquitos for transmitting infection [*cf. R.A.E.*, B **22** 110] showed that when they were used within 10 days the results were satisfactory (84 per cent. positive), but that after this period their effectiveness

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rapidly diminished and no positive results were obtained after 40 days. Thus infectiousness in mosquitos harbouring *P. falciparum* is of shorter duration than in those harbouring *P. vivax* [*loc. cit.*]

Boyd (M. F.), Kitchen (S. F.) & Mulrennan (J. A.). **On the Relative Susceptibility of the Inland and Coastal Varieties of** *A. crucians*, **Wied., to** *P. falciparum*, **Welch.**—*Amer. J. trop. Med.* **16** no. 2 pp. 159–161, 4 refs. Baltimore, Md, March 1936.

To test their relative susceptibility to infection with *Plasmodium falciparum*, examples of the inland variety of *Anopheles crucians*, Wied., from both coastal and inland localities in Florida, and of the coastal variety [*cf. R.A.E.*, B **13** 20; **20** 123] were applied to an infected man at the same time as batches of *A. quadrimaculatus*, Say. Although *A. quadrimaculatus* proved quite highly susceptible, infections (oöcysts) in *A. crucians* proved low both in number and intensity [*cf.* **22** 206]. From 53·7 to 91·6 per cent. of the examples of the former were positive, whereas the highest proportion positive among the latter was 33·3 per cent. There was no significant difference between the varieties.

Shattuck (G. C.). **The Distribution of American Leishmaniasis in Relation to that of** *Phlebotomus*.—*Amer. J. trop. Med.* **16** no. 2 pp. 187–205, 2 pp. refs. Baltimore, Md, March 1936.

The author reviews the records of the occurrence of leishmaniasis in America and attempts to correlate them with the distribution of *Phlebotomus*. The following is his summary: Circumstantial evidence indicates that American leishmaniasis is transmitted by a winged, biting insect that lives among trees or shrubs. As a result of experimental work, most of which has been conducted in the Eastern Hemisphere, it seems highly probable that all forms of leishmaniasis are usually transmitted by the bites of certain species of *Phlebotomus*. Should this hypothesis prove true, it is still possible that the disease may be transmitted occasionally by other vectors and that ulcerating forms may sometimes be conveyed by direct contact, or even indirectly by contact with infected material. In nearly all parts of the Western Hemisphere from which supposedly indigenous cases of leishmaniasis have been reported, one or more species of *Phlebotomus* which bite man are known to occur. Further search should be made for *Phlebotomus* in certain regions from which it has not been reported but in which leishmaniasis is indigenous. Further studies should also be made of the bionomics of the American species of *Phlebotomus* that bite man.

Bozhenko (V. P.).] **Боженко (В. П.). The Rôle of Bed-bugs** (*Cimex lectularius* **L.**) **in Transmission and Preservation of Tularaemia Virus.** [*In Russian.*]—*Rev. Microbiol.* **14** no. 4 pp. 436–440. Saratov, 1936. (With a Summary in English.)

In experiments between October 1931 and January 1932 in Saratov starved examples of *Cimex lectularius*, L., were allowed to feed, usually for 1–15 minutes, on mice or guineapigs showing *Bacterium tularense* in the peripheral blood. The bugs also readily fed on the cold bodies of dead animals. They were kept in clean flasks with wood shavings or pieces of filter paper on the bottom, and closed with a cork stopper with a hole covered with wire gauze to allow the access of air. The flasks

were kept in darkness at room temperature, and the infected bugs were fed on healthy guineapigs or mice 2–3 times a month. Fatal tularaemia was produced by the bites of the bugs, but only if they fed immediately or within 15 hours after feeding on infected animals. Cultures of the faeces of infected bugs, however, showed that *B. tularense* was excreted by them for periods up to over 6 months after the infection. Subcutaneous injections of suspensions of eggs laid by infected bugs, or of larvae from such eggs, did not affect mice, but they died in 4–7 days if the faeces of infected bugs were injected. Injections into mice of emulsions from cultures of faeces obtained at various periods after the bugs fed on infected animals demonstrated that the bacterium remains virulent in them for at least 136 days.

[PERFIL'EV (P. P.) & POPOV (V. V.).] **Перфильев (П. П.) и Попов (В. В.). Contributions à la faune des phlébotomes de Kuljab, Tadjikistan.** [*In Russian.*]—*Trav. Fil. Acad. Sci. URSS Tadjikistan* no. 5 pp. 15–27, 3 figs., 1 ref. Moscow, 1935.

In the course of an expedition to western Tadzhikistan during June–September 1933, over 5,000 sandflies were collected in houses and in the open in the town of Kulyab. They occurred in disused brick kilns along the banks of a river covered with abundant vegetation, in ruined buildings adjoining large stables, and in the local hospitals. The sandflies that have been recorded from Kulyab are *Phlebotomus papatasii*, Scop., *P. sogdianus*, Parr., *P. chinensis*, Newst., *P. sergenti*, Parrot, *P. sergenti* var. *mongolensis*, Sinton, *P. sergenti* var. *alexandri*, Sinton, *P. grekovi*, Khod., *P. minutus*, Rond., *P. caucasicus*, Marz., and *P. squamipleuris*, Newst., and all but the last two occurred in the collections made in 1933. *P. papatasii* and *P. sogdianus* were predominant, the former in dwellings and the latter under natural conditions; they were most numerous in mid-July, when the air temperature was highest and the humidity lowest. All the species were sometimes found in inhabited buildings, the prevalence of a particular one depending on the time of the year. Their abundance is governed by conditions of temperature and humidity, 27–29°C. [80·6–84·2°F.] (at which development of *P. papatasii* from egg to adult is completed in about a month) being apparently the optimum temperature. High humidity and temperature together are, however, unfavourable. The structure of the male genitalia and of the pharynx and spermatheca of *P. papatasii*, *P. sergenti*, *P. sergenti* var. *alexandri*, *P. caucasicus* and *P. chinensis*, and also of the buccal armature of *P. squamipleuris* is briefly described.

[PERFIL'EV (P.).] **Перфильев (П.). Contributions à la biologie, à la taxonomie et à la géographie des phlébotomes de la section** *major.* [*In Russian.*]—*Trav. Fil. Acad. Sci. URSS Tadjikistan* no. 5 pp. 29–51, 17 figs., 21 refs. Moscow, 1935.

This is a revision of the sandflies of the group of *Phlebotomus major*, Ann., that occur in the Russian Union or in adjoining countries. A list is given of the 23 species and varieties that have been described, with notes on their characters (chiefly the male genitalia) and status. The species found in the Russian Union are *P. major*, *P. chinensis*, Newst., *P. perfiliewi*, Parr., *P. kandelakii*, Shchurenkova, *P. wenyoni*, Adl., Thdr. & Lour., and *P. pirumowi*, Mirzayan. *P. perniciosus*

var. *tauricus*, Nasonov [*R.A.E.*, B **16** 110], and *P. crimicus*, Shtefko & Minkevich [**14** 190] are considered synonyms of *P. major*. *P. perfiliewi* var. *transcaucasicus*, n., found in Azerbaijan and the northern Caucasus, is differentiated by characters of the male genitalia.

P. major and *P. chinensis* occur in the Crimea, Transcaucasia and Central Asia, the former in inhabited buildings and the latter in gorges and caves. Engorged females of *P. major* invariably contained human blood, whereas those of *P. chinensis* more often contained blood with large nuclei in the erythrocytes, even when taken near dwellings. The latter species probably feeds chiefly on the blood of lizards that inhabit the caves, but man, if present there, is also attacked. Unlike the females of *P. papatasii*, Scop., those of both *P. major* and *P. chinensis* only require one full blood-meal before oviposition and refuse to suck blood repeatedly.

P. perfiliewi occurs in the Crimea and has been taken in houses and tents. The females could not be induced to feed and did not survive long in captivity. Preliminary observations showed, however, that both larvae and adults can resist moist conditions better than do other sandflies. In nature, the adults were more abundant in places with dense vegetation.

[Galuzo (I. G.).] **Галузо (И. Г.). Hôtes vecteurs des theilérioses bovines de l'URSS.** [*In Russian*]—*Trav. Fil. Acad. Sci. URSS Tadjikistan* no. 5 pp. 187–197, 4 figs., 9 refs. Moscow, 1935.

In the course of investigations on the form of piroplasmosis caused by *Theileria annulata* in cattle in Kazakstan in 1930, the Armenian Republic in 1931 and Tadzhikistan in 1933, *Hyalomma asiaticum* P. Schl. & E. Schl., was not found by the author [*cf. R.A.E.*, B **23** 1], which rendered it doubtful whether this tick is the vector. A comparison is therefore made between the distribution in the Russian Union of the disease and species of *Hyalomma*, and it is shown that *H. detritum rubrum*, P. Schl. & Olen., alone appears to be closely related to its incidence. This tick was invariably found during outbreaks of the disease in Central Asia and Armenia, and its distribution and that of *T. annulata* exactly coincided in Tadzhikistan. Of the other species, *H. savignyi*, Gerv., and *H. volgense*, Sch. & Schl., were also found in districts entirely free from the disease; and *H. marginatum*, Koch, *H. asiaticum*, *H. yakimovi*, Olen., *H. schulzei*, Olen., and *H. pavlovskyi*, Sch. & Schl., did not occur in the infected areas. Field observations in Uzbekistan in 1928 showed a complete correlation in time between the occurrence on cattle of the adults of *H. detritum rubrum* from the beginning of May to the beginning of August, and the outbreak of piroplasmosis. *H. savignyi* was then also present on cattle during the whole period of the outbreak, but during an outbreak in Tadzhikistan in 1933 from mid-June to early September, it only occurred on cattle from about mid-July to the end of August, whereas *H. detritum rubrum* was found on them from May to the end of August. The five other species of ticks present occurred at a different time. Other investigators have found that *H. volgense* infests cattle in winter, and *H. asiaticum* and *H. marginatum* in spring, at which periods piroplasmosis seldom occurs.

A further examination of the data connected with investigations in Central Asia and of the ticks used in experiments in 1927–30 [*loc. cit.*] led to the conclusion that the ticks involved, which had been identified

by Olenev as *H. asiaticum*, were in fact *H. detritum rubrum*. It may, therefore, be assumed that the transmission of *T. annulata* to cattle by this species has been confirmed experimentally.

[GALUZO (I. G.) & BESPALOV (V. M.).] **Галузо (И. Г.) и Беспалов (В. М.). Bergweiden als prophylaktische Massregel gegen die Pyroplasmose des Rindes im Hissartal.** [Mountain Pastures as a prophylactic Measure against the Piroplasmosis of Cattle in the Valley of Hissar.] [*In Russian.*]—*Trav. Fil. Acad. Sci. URSS Tadjikistan* no. 5 pp. 199–204, 1 ref., 2 fldg maps. Moscow, 1935.

In an experiment in western Tadzhikistan in the summer of 1933, cattle were taken from the valley of Hissar, where piroplasmosis and other protozoan diseases are rife, to mountain pastures, one of which was at an altitude of over 6,500 ft. During a period of 3 months only 24 animals died from diseases caused by *Piroplasma bigeminum*, *P. major* (*Françaiella colchica*) and *Theileria annulata*, all the cases occurring within 25 days of arrival at the pastures, showing that the infection was contracted while the animals were still in the valley. All the animals that remained in the valley suffered from piroplasmosis, and 65 per cent. died. Investigations on the presence of ticks in the district revealed the occurrence of 8 species, of which *Hyalomma detritum rubrum*, P. Schl. & Olen., which transmits *T. annulata* [see preceding paper], and *Boophilus annulatus*, Say, which transmits *P. bigeminum* and *P. major*, were confined to the valley, whereas the mountain pastures were only infested with *Dermacentor silvarum*, Olen., *H. marginatum*, Koch, and *H. aequipunctatum*, Olen., none of which transmits these diseases. Since, however, local cattle, probably carrying ticks, are often driven to and from the mountain pastures, the absence from them of *H. detritum rubrum* and *B. annulatus* is evidently due to the ecological conditions being unfavourable.

[POSPELOVA-SHTROM (M. V.).] **Поспелова-Штром (М. В.). Zur Systematik der Ixodiden-Gattung** *Haemaphysalis* **C. L. Koch.** [The Classification of the Ixodid Genus *Haemaphysalis*.] [*In Russian.*]—*Trav. Fil. Acad. Sci. URSS Tadjikistan* no. 5 pp. 205–217, 12 figs., 6 refs. Moscow, 1935. (With a Summary in German.)

Descriptions are given in Russian and German of the males of *Haemaphysalis pavlovskyi*, sp. n., taken on a pheasant in Tadzhikistan, and *H. pentalagi*, sp. n., on a hare in Japan; and of the hitherto unknown female of *H. japonica* var. *douglasi*, Nutt. & Warb., taken on a horse in the Russian Far East. The characters differentiating the female of this species from that of *H. concinna*, Koch, with which it has often been confused, are pointed out.

DE JESUS (Z.). **The Life History of the Australian Cattle Tick under Philippine Conditions.**—*Philipp. J. Anim. Ind.* **1** no. 6 pp. 355–369, 2 pls., 1 fig., 4 refs. Manila, 1934. **The Cattle Tick Pest in the Philippines—its Control and Eradication.**—*Op. cit.* **2** no. 4 pp. 263–281, 2 pls., 3 figs., 13 refs. Manila, 1935. [Recd. May 1936.]

In the first paper an account is given of observations and experiments carried out by the author in 1933 and 1934 on the bionomics

of *Boophilus annulatus microplus*, Can. (*australis*, Fuller), which is now prevalent in most, if not all, of the regions in the Philippines where cattle are reared.

The following is taken chiefly from the author's summary: The life-cycle was completed in 48·5 days in the dry season and in 50·5 days in the wet season, an average period of 49·5 days, of which 28 days are spent on the ground and 21·5 on the host. The average lengths of the various stages of the life-cycle in days are: pre-oviposition period as adult on the ground 3·5, egg 20·5, larval (on the ground) 4, larval (on the host) 7, nymphal 7, and adult (on the host) 7·5. A single female may lay 1,000–3,000 eggs. In the absence of a host, the larvae can survive on vegetation for 84–98 days in spite of adverse weather conditions. Cattle are the most usual hosts of this tick, but development may also take place on water-buffalos, horses and goats; in the authors experiments sheep were refractory. Although seed ticks do not apparently attach themselves to dogs, they may remain on a dog's coat for as long as 5 days, and may thus be disseminated on the ranch. The seed ticks do not bite man, but the nymphs attach themselves and engorge.

In the second paper, the author discusses the losses caused by this tick; these are due not only to irritation and loss of blood, but to the transmission of piroplasmosis (caused by *Piroplasma bigeminum*), and anaplasmosis (caused by *Anaplasma marginale*), both of which occur in cattle in the Philippines [*cf.* *R.A.E.*, B **6** 10]. The life-history of the tick is briefly reviewed [see preceding paper]. In water seed ticks remain on the surface by clinging to floating objects or together; thus rain-water may be a means of disseminating them. Ticks may also be distributed by horses, water-buffalos and goats, if these are not treated at the same time as the cattle, and mechanically on the coats of sheep and dogs or on the clothes of man. On ranches water-buffalos have not been found infested with ticks, probably because they wallow in muddy pools and their skin is often covered with a thick layer of mud.

The measures recommended for the control of the tick are burning the pasture after it has been abandoned for at least a month, keeping pastures free from cattle for 4 months so that the seed ticks starve, planting gordura grass [*Melinis minutiflora*] [*cf.* **23** 214], removing the ticks by hand, dressing or spraying with a crude petroleum emulsion every 7 days, and dipping in an arsenical preparation every 14–15 days. The construction of a dipping vat is described. The cattle egret (*Bulbulcus coromandus*) has been observed to feed on ticks on the bodies of cattle.

HOYER (D. G.). **Effects of Sunlight on Fly Sprays. A Study of Sunlight Effects on odorless and regular Pyrethrum Liquid Insecticides.** —*Soap* **11** no. 12 reprint 4 pp., 3 charts, 15 refs. New York, December 1935. [Recd. May 1936.]

The following is taken from the author's summary: The effect of sunlight and daylight on 4 representative pyrethrum fly-sprays is demonstrated in 3 charts, the first of which shows the loss in toxic effect of the sprays on exposure, the second compares the apparent pyrethrin content with the duration of exposure, and the third shows that the apparent pyrethrin content, or the amount of acidic material present, is not commensurate with the actual toxicity of the sprays

as determined biologically on house-flies. All the sprays lost approximately 65 per cent. of their toxic properties within the first two months of exposure, and an additional 25 per cent. during the next two months. Whereas the regular sprays (those that had as vehicle a domestic type of petroleum ordinarily used for fly-sprays) at once dropped rapidly in toxicity, the odourless sprays were erratic and increased slightly in toxicity during the first 4 days of exposure. This is possibly due to formation by the light rays of an unstable toxic substance within the specially treated oil vehicles of the odourless sprays.

Although no attempt was made to determine the nature of the chemical change taking place as the sprays lost their toxicity, it was found that pyrethrum fly-sprays of the odourless and regular types, stored in sealed flint glass containers, lose practically all their toxic value on exposure to ordinary sunlight and daylight. This loss is accompanied by the development of acidity within the sprays. Whether this acidity is due to the liberation of the unsaturated natural acids of pyrethrum, to development in the oil vehicle by a photochemical action, or to a combination of both, must be determined by further study.

Thompson (G. B.). **The Parasites of British Birds and Mammals. vi. Some Parasites of the Red Deer and Wild Cat.**—*Scot. Nat.* no. 219 pp. 75–78, 8 refs. Edinburgh, 1936.

Ixodes ricinus, L., and *Lipoptena cervi*, L., are recorded from red deer (*Cervus elaphus*), and *I. ricinus*, *Felicola subrostrata*, Nitzsch, and *Spilopsyllus cuniculi*, Dale, from wild cat (*Felis silvestris*) in Scotland.

Hoyer (D. G.). **Effect of Metals on Fly Sprays. A Study of the Effects of Metals and other Container Materials on Pyrethrum Liquid Insecticides.**—*Soap* **12** no. 1 reprint 2 pp. New York, January 1936. [Recd. May 1936.]

Differences of colour in commercial pyrethrum fly-sprays in metal containers have been found for several years to be associated with loss of toxicity. Sprays so affected in 1934, when individually tested by the Peet-Grady method [*R.A.E.*, B **16** 255], were 50 per cent. less toxic than unaffected sprays and the interiors of the containers were found to be covered with a brownish paint-like material. The effect on pyrethrum fly-sprays of metals and other materials used in the manufacture of metal containers was therefore investigated. Samples of tin plate, confectioner's glaze and flux were introduced separately or in combination into flint glass bottles containing chemically and biologically standardised pyrethrum fly-sprays, 1 per cent. by weight of each container ingredient being used in each sample of spray. The bottles were then sealed and kept in the dark for 10 months, being shaken and observed at frequent intervals. Data were then recorded in respect of each sample showing change in colour, loss in pyrethrin content and decrease in toxicity. The most destructive ingredient was confectioner's glaze, which caused 41·5 per cent. loss in pyrethrin content, a marked reduction in toxicity and the most apparent and serious colour changes. Deterioration caused by flux was much less than that caused by glaze, and tin plate caused

no change in appearance or toxicity of the spray, though it lost 1 per cent. in pyrethrin content.

In a further series of tests, strips of the different metals were placed with standardised pyrethrum fly-sprays, which were stored in the dark for 14 days. From the results it was concluded that copper or lead in any form are decidedly injurious. On the other hand sprays containing tin, aluminium, iron and zinc underwent no deterioration, though the period of storage was too short to admit of final conclusions. It has been established by others that zinc will cause pyrethrum extracts to turn green.

The investigation showed that tin containers, the interiors of which are free from an excess of confectioner's glaze, flux, copper, lead or lead solder may be safely used to contain pyrethrum fly sprays, but that careful selection of metal containers is necessary if the stability of the product is to be assured.

CHORLEY (J. K.). **Tsetse Fly Campaign in Southern Rhodesia.**—*J. Soc. Pres. Fauna Emp.* (N.S.) **27** pp. 15–19, 1 map, 1 ref. London, January 1936.

This is a brief account of the various measures that have been taken against *Glossina morsitans*, Westw., in Southern Rhodesia [*cf. R.A.E.*, B **23** 294, etc.].

Report of the Pan-African Health Conference held at Johannesburg, November 20th–30th, 1935.—*Quart. Bull. Hlth Org. L.o.N.* **5** no. 1 pp. 1–209, 2 figs., 3 maps, 4 graphs, many refs. Geneva, March 1936.

The subjects dealt with at the Conference were yellow fever, plague, malaria, typhus (rickettsiosis), the typhoid carrier problem, the dangers associated with locust poisoning [*R.A.E.*, A **24** 465], animal diseases communicable to man, rural hygiene and medical services in Africa, and proposals for the better co-ordination of health services in Africa. After being discussed at the plenary meetings they were referred for detailed study and report to committees, and this publication contains the reports of the committees, the resolutions of the Conference, and the relevant papers by various authors.

In Recent Extensions of Knowledge of Yellow Fever (pp. 19–59), F. L. Soper gives a thorough and concise account of the problem of yellow fever in South America as revealed by recent work in the field and laboratory [*cf.* B **22** 72; **23** 150; **24** 34, 74]. In an appendix (pp. 59–68) is reprinted the text of Decree 21,434 of May 23rd, 1932, approving the Regulations of the Service for the Prevention of Yellow Fever in Brazil. Yellow Fever in West Africa (pp. 69–78) by P. S. Selwyn-Clarke, includes a review of the history of the disease in West Africa and discussions on the validity of the mouse protection test, reservoirs of the disease, its possible vectors, the organisation of work for controlling mosquitos, and methods for preventing the dissemination of mosquitos or infected persons by means of aeroplanes. The report of C. B. Symes on Insects in Aeroplanes (pp. 79–86) has already been noticed [**24** 65]. In a note on The Position of India in regard to the Yellow Fever Question (pp. 87–88), C. A. Sprawson points out that the prevention of the introduction of the virus into India by means of aeroplanes is of the utmost importance because *Aëdes aegypti*, L.,

is prevalent and the population is not immune. Protective measures are being taken at Karachi airport, but further research work and additional preventive measures in Africa are required.

In Position in regard to Plague in the Union of South Africa (pp. 96–102), Sir E. N. Thornton reviews the history of plague, including the outbreak in 1935 [*cf.* **24** 77]. He states that, owing largely to the establishment on the railways of the elevator system, which ensures the freedom of grain from rodents, fleas and extraneous matter that might contain excreta, and to the disinfection of ships, particularly those carrying maize, plague has not been exported from the Union at least during the last 23 years. In Plague in Madagascar, and the New Knowledge gained from Research during the last three Years (pp. 103–107), G. Girard gives a brief account of the results of the recent investigations on plague (carried out by the Pasteur Institute of Tananarive), including its epidemiology [*cf.* **23** 180; **22** 156; **20** 147, 148].

The contents of the paper by G. A. P. Ross, Insecticide as a Major Measure in Control of Malaria, being an Account of the Methods and Organisation put into Force in Natal and Zululand during the past Six Years (pp. 114–134), are indicated by its title; most of the information has already been noticed [*cf.* **24** 76; **23** 8; **22** 53; etc.]. In The Control of Malaria in South Africa by Measures directed against the Adult Mosquitoes in Habitations (pp. 134–137), B. de Meillon describes experiments to determine the most satisfactory interval between sprayings against adult mosquitos in houses, and to compare the relative effectiveness of measures against larvae or adults. He concludes that the spleen rate and the size of the spleen are reduced as a result of spraying and that the more frequent the spraying the lower the rate and the fewer the infected Anophelines per hut. Moreover, in the locality under consideration, work against adults cost about one-third as much as work against larvae and was more effective. In Malaria Control in Swamps (pp. 138–139), H. S. de Boer discusses the two main types of swamps that may be treated by planting and the species of trees most suitable for each.

In Typhus and Typhus-like Diseases in South Africa (pp. 142–149), E. H. Cluver describes the three different forms of typhus that occur in South Africa [*cf.* **23** 262] and gives a brief account of the incidence and distribution of epidemic typhus, which is transmitted by lice [*Pediculus humanus*, L.], together with the measures taken to control outbreaks. The method of destroying lice on the skins used as clothing by certain native tribes, described by H. S. de Boer in Typhus Fever in Uganda and its Control (pp. 149–151), has already been noticed [**23** 245].

Kligler (I. J.), Aschner (M.) & Levine (S.). **Comparative Studies of the Louse-borne (Epidemic) and Flea-borne (Murine) Typhus Viruses.**—*Brit. J. exp. Path.* **17** no. 1 pp. 53–60, 11 refs. London, February 1936.

The following is taken from the authors' summary: Experiments on cross-immunisation, as well as those in mice, indicate that typical louse-borne and flea-borne strains of *Rickettsia* can be differentiated both antigenically and biologically. The accumulated evidence

supports Nicolle's view that the two types, though probably having a common origin, are at present distinct [*cf. R.A.E.*, B **20** 245].

PINKERTON (H.). **Criteria for the Accurate Classification of the Rickettsial Diseases (Rickettsioses) and of their Etiological Agents.**—*Parasitology* **28** no. 2 pp. 172–189, 2 pls., 27 refs. Cambridge, March 1936.

The author discusses the classification of rickettsia diseases, which are caused by minute but non-filtrable bacterium-like micro-organisms, characteristically intracellular in habit, which multiply in their Arthropod vectors as well as in their mammalian hosts. A large number of morphologically similar but non-pathogenic intracellular micro-organisms have been described in Arthropods, and it has been suggested that the causal agents of the rickettsia diseases may be members of this group and that their pathogenicity for mammals may be an accidental phenomenon. Excluding trench fever and dengue, which have not been transmitted to laboratory animals and in which the causal agents have not been established with certainty, they include typhus, spotted fever, tsutsugamushi disease and heartwater. He points out that the way in which they are at present classified is unsatisfactory, and from morphological, histopathological and immunological studies of seven strains of such diseases, he defines and tabulates criteria on which he believes an accurate classification may be based. The strains studied fall into two widely separated groups, typhus and spotted fever, and there is reason to suppose that the mite-borne diseases (of which tsutsugamushi disease is the prototype) form a third group, although definite proof of this is not yet available. On morphological grounds the causal organisms of this group of diseases appear to be closely allied to bacteria and widely separated from Protozoa.

The following is taken from the author's summary: Diseases of the spotted fever group are carried by ticks and those of the typhus group by lice (*Pediculus humanus*, L., and *Polyplax spinulosa*, Burm.) and fleas. The histopathological lesions distinguishing the two groups are described. In the spotted-fever tick, organisms are intranuclear as well as intracytoplasmic, they invade nearly all types of tissue, and are transmitted hereditarily. In lice and fleas infected with typhus, the organisms are intracytoplasmic only, they infect only the lining cells of the gut, and are not transmitted hereditarily. Neither focal brain lesions nor scrotal sac exudation is important in differential diagnosis, since both occur in certain strains of spotted fever as well as in typhus.

All reported rickettsia diseases of man as well as their causal agents are classed according to the criteria presented, and, with the exception of the incompletely studied mite-borne group, they all appear to be varieties of typhus or spotted fever. These two groups are so different as to indicate that their causal organisms should be placed in separate genera, and it is suggested that *Rickettsia prowazeki* should be used for all organisms of the typhus group and *Dermacentroxenus rickettsi* for those of the spotted fever group [*cf. R.A.E.*, B **10** 27, 189; **14** 103]. Varieties, when established by the demonstration of definite and constant biological differences, should be indicated by varietal names, such as *Rickettsia prowazeki mooseri* (for endemic flea-borne typhus in all parts of the world).

Iyengar (M. O. T.). **Entry of *Filaria* Larvae into the Body Cavity of the Mosquito.**—*Parasitology* **28** no. 2 pp. 190–194, 1 pl., 3 figs., 4 refs. Cambridge, March 1936.

From examination of serial sections of reared examples of *Culex fatigans*, Wied., and of *Mansonia* (*Mansonioides*) *annulifera*, Theo., experimentally infected with *Filaria* (*Wuchereria*) *bancrofti* and *F. malayi*, respectively, and subsequently fixed at consecutive intervals of 10 minutes, it appears that the microfilariae enter the haemocele of the mosquito by penetrating the gut wall in the cardiac portion of the mid-gut, especially the proventriculus, and not in the stomach as was previously supposed. The microfilaria casts its sheath and enters the haemocele of the thorax as a larva in a remarkably short time, frequently in less than an hour after the infective meal and in a few cases within 20 minutes. On escaping into the perivisceral cavity from the proventriculus, the larva moves about in the spaces between the muscle bundles for some time before working its way into the centre of the bundle, where it finally stretches out parallel to the muscle strands and becomes dormant. No larvae were seen in the haemocele of the abdomen.

Mettam (R. W. M.) & Carmichael (J.). **Turning Sickness, a Protozoan Encephalitis of Cattle in Uganda. Its Relationship with East Coast Fever.**—*Parasitology* **28** no. 2 pp. 254–283, 1 pl., 34 refs. Cambridge, March 1936.

The authors describe a specific protozoan disease of cattle, " turning sickness," which occurs sporadically in areas of Kenya and Uganda where African coast fever is found. The possible relation of the two diseases is discussed. All attempts at transmission, with brain tissue or blood, were unsuccessful, and several experiments showed that it was impossible to transmit turning sickness by feeding *Rhipicephalus appendiculatus*, Neum., on calves recovered from African coast fever. In addition it would appear that such ticks were also free from infection with African coast fever, since they failed to infect calves that subsequently proved susceptible on exposure to natural infection. Emulsions made from ticks collected on sick animals at all phases of their life-history also failed to transmit.

Wigglesworth (V. B.). **Symbiotic Bacteria in a Blood-sucking Insect, *Rhodnius prolixus* Stål (Hemiptera, Triatomidae).**—*Parasitology* **28** no. 2 pp. 284–289, 4 figs., 11 refs. Cambridge, March 1936.

A bacterial organism that occurs constantly in *Rhodnius prolixus*, Stål, is described. It is present inside the cells at the cardiac end of the mid-gut in the unfed newly-hatched insect. Some days after the bug feeds, the bacteria are set free in the cavity of the gut and multiply in the undigested blood in the stomach. They are ultimately digested in the intestine. The organisms persist inside and outside the cells throughout the life of the bug, and they are transmitted through the egg, but the details of this transmission have not been worked out. Morphologically they resemble diphtheroid bacilli in being highly pleomorphic and in giving rise to thread-like forms in old cultures. Similar organisms occur in *Triatoma rubrofasciata*, DeG., *T. infestans*, Klug, and *Eutriatoma flavida*, Neiva.

In experiments carried out by Dr. R. P. Hobson, larvae of *Lucilia* were fed on sterile serum, serum infected with the organism from *Rhodnius*, and sterile serum plus non-autolysed yeast extract. At the end of 6 days, the larvae on these three media were respectively 4, 40 and 120 times their original weight. These results support the theory that the bacteria in *Rhodnius* provide "vitamin B," which is lacking in blood, and that symbiotic organisms in exclusively blood-sucking insects provide an endogenous source of vitamin.

SPARROW (H.). **Essais de vaccination avec les rickettsias du virus murin 1 de Tunis.**—*C. R. Acad. Sci. Fr.* **201** no. 27 pp. 1524–1525. Paris, 1935. [Recd. May 1936].

NICOLLE (C.). **Réflexions au sujet de la note précédente de Mme. Sparrow.**—*T.c.* p. 1526.

A murine typhus virus was successfully cultured by series of passages in lice [*Pediculus humanus*, L.] inoculated by Weigl's method [*cf.* *R.A.E.*, B **11** 199]. The virus developed as rickettsiae in the gut, and this development, comparatively slow at the first 3 passages, became accelerated in subsequent ones and then resulted in the death of the lice in 3–4 days. When the virus in the form of rickettsiae from lice was inoculated into laboratory animals it did not cause any apparent disease, but produced in them a high degree of immunity from epidemic or murine typhus.

In the second paper the author suggests that, if it is found that passage through lice weakens the action of the murine virus on man, new strains might be obtained that could be used in its place as a less dangerous living vaccine.

ROBIN (A.). **Evolution d'une hémogrégarine de saurien chez des moustiques.**—*C. R. Acad. Sci. Fr.* **202** no. 6 pp. 512–515. Paris, 1936.

The author found a haemogregarine parasite, here described as *Hepatozoon mesnili*, sp. n., at Saigon in *Gecko verticillatus*, which feeds on insects, chiefly mosquitos. *Culex fatigans*, Wied., and *Aëdes* (*Stegomyia*) *albopictus*, Skuse, become infected by biting the gecko, and the latter acquires infection by eating infected mosquitos.

SERGENT (Ed.), DONATIEN (A.), PARROT (L.) & LESTOQUARD (F.). **Cycle évolutif du sporozoaire *Theileria dispar*, agent de la theilériose bovine des pays méditerranéens chez le boeuf et chez une tique.**—*C. R. Acad. Sci. Fr.* **202** no. 10 pp. 809–811, 1 ref. Paris, 1936.

The blood of cattle that have survived an acute attack of the form of piroplasmosis caused by *Theileria dispar* contains the gametocytes for several years. These develop in the gut of *Hyalomma mauritanicum*, Senevet. The larva and nymph of this tick feed successively on the same animal. The engorged nymph detaches itself and hibernates for 6–8 months, the adult appearing in the following summer and attacking another animal. *T. dispar* accomplishes its schizogonic cycle on cattle and its sporogonic cycle in the tick, in which the zygotes develop in the epithelial cells and in the lumen of the larva-nymph. The sporonts and the sporoblasts (generators of the sporozoites) develop in the salivary glands of the adult tick. There is no

hereditary infection. The most remarkable point of the sporogonic cycle is the encystment of the zygote in the gut of the hibernating nymph.

LEGENDRE (J.). **La pénétration continentale du moustique maritime.**—*C. R. Acad. Sci. Fr.* **202** no. 10 pp. 874–876, 2 refs. Paris, 1936.

Following previous work on *Aëdes caspius*, Pall. (*punctatus*, Mg.) in France [*R.A.E.*, B **23** 214], the author investigated the distance for which flooding by the tide can produce suitable breeding places. Larvae were found over 3 and adults nearly 5 miles from the coast. It is therefore evident that *A. caspius* breeds wherever it finds stagnant salt water. To test whether *Culex pipiens*, L., which is common in the same district, would breed in salt water, the author removed larvae and pupae of *A. caspius* and introduced young larvae of *C. pipiens*. After 3 hours these were all dead, while those in a control vessel of fresh water were still living. In a second test, mature larvae were all killed in 24 hours, but pupae produced adults.

BLANC (G.) & BALTAZARD (M.). **Longévité du virus du typhus murin chez la puce** (*Xenopsylla cheopis*).—*C. R. Acad. Sci. Fr.* **202** no. 17 pp. 1461–1463. Paris, 1936.

On 10th December 1935, a rat infected with the virus of murine typhus of Casablanca was placed in a jar containing 1,150 examples of *Xenopsylla cheopis*, Roths., that had been kept without food for 5 days. The rat died during the following night so that the fleas fed on it for 16–18 hours. On 13th December a fresh rat was put into the jar and removed after 48 hours. The fleas were starved for 48 hours and then another rat was introduced, the experiment continuing in this manner for 100 days. The results are given in a table showing that the fleas remained infective throughout this period.

LESTOQUARD (F.) & DONATIEN (A.). **Sur une nouvelle** *Rickettsia* **du mouton.**—*Bull. Soc. Path. exot.* **29** no. 2 pp. 105–108, 1 ref. Paris, 1936.

The authors describe observations and experiments which lead them to conclude that sheep in Turkey and Algeria are subject to a disease caused by a new species of *Rickettsia*, for which they propose the name *R. ovina*. In Algeria, rickettsiae similar to those found in the blood of sheep were observed in examples of *Rhipicephalus bursa*, C. & F., that had engorged on an infected sheep, and sheep inoculated with suspensions of ticks of this species taken partly engorged from apparently healthy sheep showed a temperature reaction and rickettsiae in the peripheral blood; it is therefore suggested that this tick is the vector.

ROUBAUD (E.) & TREILLARD (M.). **Infection expérimentale de** *Glossina palpalis* **par un coccobacille pathogène pour les muscides.**—*Bull. Soc. Path. exot.* **29** no. 2 pp. 145–147, 1 ref. Paris, 1936.

In continuation of previous work [*R.A.E.*, B **23** 242], experiments, which are described, were undertaken to determine the reaction of *Glossina palpalis*, R.-D., to infection with the coccobacillus [*Bacterium*

mathisi] isolated from *G. morsitans*, Westw. In January adults obtained from pupae that had recently been sent from Uganda were allowed to bite the abdomens of guineapigs that had been smeared with cultures of the bacillus, either isolated directly from *G. morsitans* in the previous June and maintained on gelose, or reactivated by passage through examples of *G. palpalis* or house-flies (*Musca domestica*, L.) infected by means of inoculations. The results showed that *G. palpalis* may contract a fatal infection in this way but that it is apparently less susceptible than *G. morsitans*. No natural infection with this bacillus was observed among the adults reared for the experiments.

TREILLARD (M.). **Tableau synoptique pour la détermination rapide des anophèles d'Afrique (région paléarctique méditerranéenne et région aethiopienne). 1. Adultes.**—*Bull. Soc. Path. exot.* **29** no. 2 pp. 148–150, 1 diagr., 2 refs. Paris, 1936.

The author gives a synoptic table, with explanatory diagrams, for the identification of the adults of the more easily distinguishable species of Anopheles of Africa, which is similar to the one already devised for Indo-China [*R.A.E.*, B **23** 35].

SOKOLOW (N.) & TARVIT (I.). **La résistance des phlébotomes au froid.** —*Bull. Soc. Path. exot.* **29** no. 2 pp. 150–156, 13 refs. Paris, 1936.

This study of the resistance of adults of the genus *Phlebotomus* to cold was undertaken in Uzbekistan with a view to elucidating ultimately the question of the stage in which hibernation occurs. The work was carried out with collections made at the end of July and the beginning of August, in which *Phlebotomus papatasii*, Scop., predominated. Preliminary tests showed that the sandflies became torpid at 10°C. [50°F.], but could be roused by shaking. In experiments in which they were exposed for different lengths of time to various temperatures below freezing point they did not revive after 21 hours exposure at −2°C. [28·4°F.] or 30 minutes at −7°C. [19·4°F.], but some survived 5 minutes at −8°C. [17·6°F.]. Females were more resistant to freezing than males and did not become torpid so soon.

The quantities of water and of fat present in an organism are of importance in determining the degree of resistance to cold [*cf. R.A.E.*, A **17** 126, etc.]. Experiments are described in which the quantity of water in a frozen state in the bodies of *Phlebotomus* was determined at various temperatures below freezing point. Water represented 62·5 per cent. of the weight of the females and 70·8 per cent. of that of males. In females, 23·2 per cent. of the water was frozen at −1·8°C. [28·76°F.] and 46·7 per cent. at −6·8°C. [21·76°F.]. In males 11·1 per cent. of the water was frozen at −2·5°C. [27·5°F.] and 100 per cent. at −10°C. [14°F.]. The amount of fat was determined by extraction and weighing ; it comprised 3·54 per cent. of the weight of females and 2·50 per cent. of that of males.

MONTESTRUC (E.). **Le paludisme à la Martinique.**—*Bull. Soc. Path. exot.* **29** no. 2 pp. 193–202, 1 map, 1 ref. Paris, 1936.

The author reviews the history of malaria in Martinique and gives the results of a malaria survey. A brief Anopheline survey carried out

by G. Senevet in July 1934 revealed the larvae of *Anopheles tarsimaculatus*, Goeldi, in a canal, a marsh, etc., and those of *A. argyritarsis*, R.-D. (*allopha*, Peryassú) in seepages near a river.

Sergent (A.). **Epreuve de la prémunition croisée appliquée à quelques souches algériennes de spirochétose hispano-africaine.**—*Bull. Soc. Path. exot.* **29** no. 3 pp. 245–251, 2 figs., 3 refs. Paris, 1936.

From the results of cross-immunity tests it is concluded that a strain of *Spirochaeta hispanica* isolated from man in Algeria [*cf. R.A.E.*, B **21** 230] and one isolated from the tick, *Rhipicephalus sanguineus*, Latr., at the same time in the same locality [*cf.* **21** 245], both of which have been maintained in the laboratory for 2½ years, are identical, and that another strain isolated from man in a different locality [**24** 46] and kept in the laboratory for 3 months, belongs to the same species but is more virulent.

Treillard (M.). **Tableau synoptique pour la détermination rapide des anophèles d'Asie (régions orientale et extrême-orientale). 1. Adultes.**—*Bull. Soc. Path. exot.* **29** no. 3 pp. 279–282, 1 chart, 1 ref. Paris, 1936.

The finding of *Anopheles culicifacies*, Giles, in Indo-China [*cf. R.A.E.*, B **23** 147] has led the author to revise his synoptic table for the identification of adult Anophelines of Indo-China [**23** 35] so as to include all the species of *Anopheles* known from the continent and islands of Asia, with the exception of certain species and varieties that cannot be conveniently differentiated by this means.

Catanei (A.). **Sur les gîtes à larves d'anophèles des lacs de Savoie.**—*Arch. Inst. Pasteur Algérie* **14** no. 1 pp. 18–22, 2 pls., 7 refs. Algiers, March 1936.

A study of the lakes in the Departments of Savoie and Haut-Savoie has shown that they do not as a rule provide suitable breeding places for Anophelines, largely owing to the action of the wind in ruffling the surface of the water and to the presence of larvicidal fish. On the other hand larvae of *Anopheles maculipennis*, Mg., have been found in large numbers in the affluents and effluents of the lakes and in marshes near their borders. These marshes, which sometimes cover a large area, are not, however, always suitable for larval development, since the water is often stagnant and muddy, and full of decomposing vegetable matter. The breeding places on the slopes of the hills near the lakes contained aquatic vegetation and sometimes filamentous green algae, and were often shaded ; most of these harboured larvae of *A. claviger*, Mg. (*bifurcatus*, auct.).

Sergent (Et.). **Un procédé simple de conservation des oeufs d'anophèles.**—*Arch. Inst. Pasteur Algérie* **14** no. 1 p. 23. Algiers, March 1936.

To preserve Anopheline eggs so that they retain their natural appearance and morphological characters, they may be placed by means of a pipette on a drop of gum arabic (containing 1 per cent. formol) that has

previously been spread on a slide. When the gum arabic has dried, setting the eggs, a second drop of the same solution is allowed to fall on to them and a slide is placed over the top.

SENEVET (G.) & CAMINOPETROS (J.). **Une nouvelle variété de l'*Haemaphysalis punctata*.**—*Arch. Inst. Pasteur Algérie* **14** no. 1 pp. 24–29, 3 figs., 2 refs. Algiers, March 1936.

The authors briefly discuss the status of *Haemaphysalis cinnabarina*, Koch (*chordeilis*, Pack.) and *H. cinnabarina* var. *punctata*, C. & F., and give a description of the male and female of *H. cinnabarina* var. *cretica*, n., which was taken on sheep in a region of Crete where sheep paralysis probably occurs, with keys to both sexes of these three forms.

PARROT (L.). **Notes sur les phlébotomes. XVII. Phlébotomes d'Ethiopie.**—*Arch. Inst. Pasteur Algérie* **14** no. 1 pp. 30–47, 16 figs., 14 refs. Algiers, March 1936.

A collection of sandflies made at Diré Dawa, Abyssinia, in April–May 1935 comprised the following species: *Phlebotomus langeroni* var. *orientalis*, n., *P. viduus*, sp. n., *P. martini*, sp. n., *P. papatasii* var. *bergeroti*, Parr., *P. schwetzi* var. *aethiopicus*, n., *P. africanus* var. *longior*, n., *P. africanus* var. *ater*, n., *P. tiberiadis*, Adl., Thdr. & Lour., *P. sanneri*, Gall. & Nitzu., and *P. squamipleuris* var. *dreyfussi*, Parr. *P. viduus* and *P. africanus* var. *ater* are described from the female only, and the other new forms from both sexes.

PARROT (L.). **Notes sur les phlébotomes. XIX. Phlébotomes de Crète.**—*Arch. Inst. Pasteur Algérie* **14** no. 1 pp. 50–52, 1 fig., 7 refs. Algiers, March 1936.

A collection of sandflies made in Crete during September 1935 comprised *Phlebotomus papatasii*, Scop., *P. sergenti*, Parr., *P. major*, Ann., *P. chinensis* var. *simici*, Nitzu., *P. vesuvianus*, Adl. & Thdr., and *P. parroti* var. *italicus*, Adl. & Thdr., of which the last four have not previously been recorded from the Island. The author considers that the male of *P. parroti*, Adl. & Thdr., from Crete studied by Nitzulescu [*cf. R.A.E.*, B **19** 161] was probably var. *italicus*. He gives notes on the characters of the female of *P. vesuvianus* and regards it as distinct from *P. larrousei*, Lngn. & Nitzu. [*cf.* **20** 98].

SERGENT (Et.). **Etude du venin des scorpions d'Algérie (doses minima mortelles pour les animaux de laboratoire).**—*Arch. Inst. Pasteur Algérie* **13** no. 1 pp. 39–41. Algiers, March 1935. **Piqûres de scorpion en Algérie (1934).**—*Op. cit.* **14** no. 1 pp. 53–61, 1 fig., 3 refs. March 1936.

In the first paper are given the results of experiments to determine the relative virulence for mice and guineapigs of the venom of three common species of scorpions from Algeria. In the second, on the basis of the 106 answers to a questionnaire sent to doctors practising in rural areas of Algeria, the author gives a map showing the localities where bites by scorpions have been recorded and the degree of severity of the symptoms. Cases of death from scorpion bite occur annually in 7 districts and occasionally in 9 others. In 51 others bites without fatal consequences have been recorded, and in 39 no cases have been treated.

The places where fatal cases have occurred are nearly all in the Saharan Atlas or in the western Sahara ; only one is in the Little Atlas. Lists are given of the scorpions found in Algeria and those from the localities where fatal cases habitually occur.

Technique pour le transport d'oeufs frais d'anophèles.—*Arch. Inst. Pasteur Algérie* **14** no. 1 p. 84, 1 fig. Algiers, March 1936.

To send fresh Anopheline eggs by post a strip of thick blotting paper should be placed diagonally in a bottle about 3 inches high so that the lower end rests on the bottom and the upper end is held between the neck and the cork. The paper should be moistened but not sufficiently to drip, care being taken to keep the sides of the bottle dry. A single female engorged with blood should be introduced into the bottle, the cork sealed with paraffin wax, and the bottle despatched. Eggs can thus be deposited *en route*.

WEYER (F.). **Einige Erfahrungen bei der Aufzucht von Steckmückenlarven.** [Some Experiences in breeding Mosquito Larvae.]—*Zbl. Bakt.* (1 Orig.) **136** no. 1–2 pp. 111–116, 2 figs., 10 refs. Jena, 13th February 1936.

For breeding larvae of *Culex pipiens*, L., and *C. fatigans*, Wied., hay infusion provided suitable food. When breeding *Anopheles maculipennis*, Mg., water containing saprophytic algae was used. The addition of animal matter, such as dried liver, caused the algae to develop very rapidly and vigorously. The increased algal flora not only served as food for the larvae, but also, by supplying oxygen, kept the water fresh, rendering change or aeration superfluous and hindering decomposition of the added animal substance. This method gave excellent results.

ZOTTA (G.). **Races d'*Anopheles maculipennis* en Yougoslavie. (Note préliminaire sur les recherches faites en Yougoslavie pendant l'été de 1934.)**—*Arch. roum. Path. exp. Microbiol.* **8** no. 4 pp. 427–447, 1 fldg. map, 1 ref. Paris, December 1935. [Recd. May 1936.]

In this preliminary report the author records observations made in June–August 1934 on the distribution of the different races of *Anopheles maculipennis*, Mg., in various localities in Croatia, Dalmatia, Montenegro and Macedonia, where, in general, the incidence of malaria is high. The geography of the regions studied is briefly described.

A. maculipennis is uniformly distributed throughout these regions, but *A. superpictus*, Grassi, predominates in central and southern Dalmatia, in Montenegro and in the greater part of Macedonia. The part it plays in the transmission of malaria is considerable, more especially as it appears later than *A. maculipennis* and is probably responsible for a second wave of malaria. The races of *A. maculipennis* were differentiated by means of the characters of the eggs.

The following is taken largely from the author's summary : In the part of Croatia studied mixed populations of the typical form and var. *messeae*, Flni., predominated, though pure populations of the typical form occurred in the hilly parts and one batch of eggs of var. *atroparvus*, van Thiel, was also obtained. Only the typical form and var. *messeae* occurred in Macedonia ; they were usually found in association only in the marshy plains with stagnant water, and almost pure populations

of the typical form were most common. In the central region of Dalmatia these two races also occurred with the addition of *labranchiae*, Flni. The western region of Dalmatia is characterised by the typical form in association with var. *labranchiae*, and the southern region of Dalmatia and Montenegro towards the coast by var. *messeae* and *A. sacharovi*, Favr (*elutus*, Edw.). Zoo-geographically var. *labranchiae* is associated with the typical form, and var. *messeae* with *A. sacharovi*. Aberrant forms were found among the eggs of the typical form and of var. *messeae*.

OTERO (F. Q.). **El problema del paludismo en la cuenca del Esla (Zamorra).** [The Malaria Problem in the Basin of the Esla.]—*Med. Países cálidos* **9** no. 4 pp. 160–187, 5 figs., 1 map. Madrid, April 1936.

An investigation in 1932 in the zone round the reservoir formed by damming the river Esla in the province of Zamorra, Spain, showed malaria in the villages to be sporadic and limited to part of the hot season. Larvae of *Anopheles maculipennis*, Mg., were found in ponds and in standing water near dwellings, and the adults were taken in cow-sheds and pig-sties. Larval development required 44 days in April–May at an average temperature of 14·7°C. [58·46°F.] and 16–20 days in July–August at 23·8°C. [74·84°F.].

SCHWETZ (J.). **Observations et recherches sur le paludisme dans le Congo Belge.**—*Riv. Malariol.* **15** Sez. 1 fasc. 1–2 pp. 60–75, 146–152, 24 refs. Rome, 1936. (With a Summary in Italian.)

This is a summary of published papers on malaria in the Belgian Congo, of which those dealing with mosquitos have been noticed [*R.A.E.*, B **15** 103 ; **18** 209 ; **19** 105].

CORRADETTI (A.). **Alcune ricerche sull'*Anopheles maculipennis*.** [Some Investigations on *A. maculipennis*.]—*Riv. Malariol.* **15** Sez. 1 fasc. 2 pp. 106–113, 1 fig. Rome, 1936. (With a Summary in English.)

Some variations of the exochorion in eggs of *Anopheles maculipennis* var. *labranchiae*, Flni., are described from Latium. The larvae and adults from these eggs were identical with *labranchiae*. The adults were eurygamic and laid fertile eggs only when they had paired with males of var. *atroparvus*, van Thiel. The eggs in only 1 of 23 egg-batches, fertile and unfertile, had the characters of the preceding generation, all the others having those of normal *labranchiae*.

When females of the different races of *A. maculipennis*, Mg., were given the opportunity of feeding on guineapigs or man, respectively, the percentages that fed were 8 and 7·6 for *maculipennis* (*typicus*), 1·1 and 1·1 for *melanoon*, Hackett, 63·1 and 40 for *atroparvus*, and 87·1 and 84·2 for *labranchiae*. It is therefore thought that the first two races have specific preferences for certain species of animals, while *atroparvus* and, especially, *labranchiae* have wide preferences or none at all.

The percentages of males in *labranchiae* bred in the laboratory showed only slight variations from the average of 47·81. In experiments from March to October, the males usually required about a day less to complete the egg, larval and pupal stages than the females.

BALFOUR (M. C.). **Some Features of Malaria in Greece and Experience in its Control.**—*Riv. Malariol.* **15** Sez. 1 fasc. 2 pp. 114–131, 6 refs. Rome, 1936. (With a Summary in Italian.)

This is a general review of six years field experience in Greece. Reference is made to the fluctuations in malaria incidence noted in a previous report [*R.A.E.*, B **23** 282], and the monthly distribution of rainfall is suggested as the most important factor. In 1935 an absence of rain in May led to an early development of *Anopheles superpictus*, Grassi. Rains in August, particularly if heavy and of short duration, are unfavourable to this species, as the larvae are washed out of their important breeding places in torrents and streams. A list is given of the eight species of *Anopheles* found, which are the nine already recorded [**24** 48] except *A. italicus*, Raff. Barber has proved *A. sacharovi*, Favr (*elutus*, Edw.) to be the most important vector of malaria [**24** 35]. *A. superpictus* and *A. sacharovi* are of great importance in some areas, and while the races of *A. maculipennis*, Mg., present (the typical form and var. *messeae*, Flni.) appear relatively innocuous [*cf.* **21** 167], it has not yet been decided to disregard this species in applying measures for control. *A. claviger*, Mg., *A. algeriensis*, Theo., and *A. hyrcanus*, Pall., are essentially rural species that feed on animals, and the special breeding requirements of *A. plumbeus*, Steph., and *A. marteri*, Sen. & Prun., and their limited distribution are probably sufficient to eliminate them from serious consideration. At Marathon and Kavalla *A. sacharovi* has been caught about 3 miles from the breeding places, and it is believed that *A. superpictus* can fly an equal or greater distance, for in central Greece anti-larval measures had to be extended to a radius of 3·4 miles. The seasonal prevalence indicated for *A. superpictus*, *A. sacharovi* and *A. maculipennis* is practically the same as already noted [**21** 167]. Epidemics are probable in years in which conditions favour both *A. superpictus* and *A. sacharovi*.

Drainage has proved successful in controlling malaria in the Marathon plain, and is used to supplement or replace Paris green in other districts. In 1932 screening was tested at a village on the coast near Kavalla where *A. sacharovi* was abundant and malaria hyperendemic, and there is evidence that a significant reduction in the incidence of the disease has been effected. *Gambusia* was introduced into Greece from Italy in 1928, and a special field study of its action is being conducted in the plain of Lamia. It is doubtful whether it can control larvae of *A. superpictus* in torrents subject to floods.

LINDBERG (K.). **Le Paludisme dans l'Iran.**—*Riv. Malariol.* **15** Sez. 1 no. 2 pp. 132–145, 1 map, 2 pls., 9 refs. Rome, 1936. (With a Summary in Italian.)

Malaria is regarded as the chief disease in Persia. During a journey in September and October 1935, the author was able to collect Anopheline larvae and make spleen examinations in localities on the Persian gulf and scattered throughout the country up to the Caspian sea. A description is given of the route followed, with notes on the spleen indices and larvae found, particulars of the breeding places of the latter being given. The species recorded are *Anopheles superpictus*, Grassi, in most parts of the country ; *A. maculipennis*, Mg., in the north-west ; *A. culicifacies*, Giles, and *A. stephensi*, List., in the south-east ; and *A. turkhudi*, List., in the south-west.

Senior-White (R.). **Malaria Control by Subsoil Drainage at Waltair.** —*Rec. Malar. Surv. India* **6** no. 1 pp. 13–18, 2 pls., 4 refs. Calcutta, March 1936.

The author briefly reviews the history of malaria control at Waltair, the important railway station and colony of Vizagapatam, which adjoins the backwater that is being converted into Vizagapatam harbour [*cf. R.A.E.*, B **23** 127]. The malaria incidence in the colony has been reduced from 52 per cent. in 1926 to 0·1 per cent. in 1934. The measures consisted chiefly in filling and draining Anopheline breeding places and the application of Paris green and oil. Between 1932 and 1935, the open drains were converted into subsoil ones, using local stone instead of pipes. The construction of these drains is described and illustrated ; the cost is given together with the amount that has been saved in oil and in labour for applying it. The drains have paid for their cost in under two years ; moreover they have eliminated the need for constant repairs of damage by cattle that still occurs in open sections.

Neogi (S. K.). **Study of the Bionomics of** *Anopheles sundaicus* (*A. ludlowi*) **in the Salt Lakes of Calcutta.**—*Rec. Malar. Surv. India* **6** no. 1 pp. 31–47, 1 map, 2 charts, 9 refs. Calcutta, March 1936.

The salt lakes to the east of Calcutta contain saline water varying in depth from a few inches to 1½ ft. in the dry season and reaching a depth of 3 ft. in the rains ; they are covered with algae and other floating vegetation and receive the sullage from adjacent areas. Before 1932 *Anopheles sundaicus*, Rdnw. (*ludlowi*, auct.) was not found breeding in them [*cf. R.A.E.*, B **19** 236], although the danger of its doing so was foreseen [*cf.* **20** 195, 196]. Since that time it has become increasingly important in and around Calcutta, owing to the proximity of breeding places and the gradually widening area that it has invaded during the last 2½ years. The risk that it would be introduced by country boats from the Sunderbans, where it occurs normally, has been present since the cutting of the various navigation canals, and the present investigation was undertaken with a view to studying the changes in various factors that have made possible its establishment in recent years. The coefficients of correlation between the breeding of *A. sundaicus* and salinity, algae, organic pollution and temperature have been worked out from previous records or from the author's own data. Calculations using a method of partial correlation (in which the other factors are kept constant) show that the coefficients of correlation between breeding and salinity or the presence of algae are high, positive and significant ; whereas that between breeding and organic pollution is low, positive and of no significance. Thus the present salinity of the lake is suitable for the development of the larvae of *A. sundaicus*. Although there is no evidence to show that the degree of salinity was formerly high, there is a certain amount of evidence to show that it is decreasing. The change in the salinity has been brought about chiefly by the silting up of the Bidyadhari river, which prevents the access of the tides to the lakes, and consequently the renewal of the salt content, which is being lowered by rainfall. Thus the presence of larvae of *A. sundaicus* in the lakes may be reasonably ascribed to a change in the range of salinity. The more or less stagnant condition of the waters since the removal of tidal influence has favoured the

growth of algae, which by supplying food and shelter to the larvae have no doubt also helped in the establishment of the species.

Various methods of control are discussed ; it is suggested that breeding could be eliminated by increasing or decreasing the salinity of the lake water. The introduction of saline water by means of tides in the Bidyadhari is impracticable in the present state of the river, but the introduction of silt-laden fresh water from the Hooghly would not only make the water less saline but also raise the ground level by the deposition of the silt, making it suitable for cultivation or habitation.

RAMSAY (G. C.), CHANDRA (S. N.) & LAMPRELL (B. A.). **A Record of an Investigation to determine the Androphilic Indices of certain Anopheline Mosquitoes collected on Tea Estates in Assam and Northern Bengal.**—*Rec. Malar. Surv. India* **6** no. 1 pp. 49–52. Calcutta, March 1936.

The investigation described was carried out during 1933–34 to determine whether the feeding habits of the local Anophelines would explain the variations in their malaria infectivity indices observed in the tea districts of Assam and Bengal [*cf. R.A.E.*, B **21** 76, 226, etc.]. Mosquitos that had recently engorged were collected from dwellings and cattle-sheds in coolie lines. They could be caught more easily in cattle-sheds, but actually approximately equal numbers were taken from each of these sites. After each female had been identified, its stomach contents were expressed on to a piece of filter paper and subsequently tested with precipitin anti-sera specific against the blood of man and ruminant animals. The blood was identified in 3,347 cases out of 3,720 ; the highest numbers of unidentified bloods came from *Anopheles vagus*, Dön (118) and *A. subpictus*, Grassi (65), a fact suggesting that these species prefer blood other than that of man or ruminants. For all species of which more than 100 examples were examined, the " androphilic index " or percentage that had fed wholly or partly on human blood was calculated, with the exception of *A. splendidus*, Koidz., which had not fed on man. Infectivity surveys have shown that, in over 100,000 dissections, 98·3 per cent. of the mosquitos infected with malaria were *A. minimus*, Theo., and the precipitin tests demonstrated that this species prefers to feed on man (index 85·7). *A. leucosphyrus*, Dön., also appears to select human blood (index 75·5), but the authors have not found it to be a malaria vector. *A. maculatus*, Theo., and *A. philippinensis*, Ludl., are zoophilic (indices 5·4 and 6·4 respectively). A gland infection has been found by the authors in *A. annularis*, Wulp, and gut infections in *A. kochi*, Dön., but the infection rates were low and both are markedly zoophilic in nature (indices 1·6 and 3·8 respectively). *A. karwari*, James (index 16·4) and *A. hyrcanus* var. *nigerrimus*, Giles (3·8) were abundant throughout the region, but although more than 15,000 of each have been dissected none has been found infected. Less than 100 examples of the other 8 species were examined, so that no definite conclusion can be drawn regarding their feeding habits. They include *A. jeyporiensis*, James, in which one gut infection has been found in over 2,000 dissections, and *A. culicifacies*, Giles, which is fairly prevalent during the early months of the year but does not appear to find suitable breeding conditions during the monsoon season. The latter has been found by the authors to be a malaria vector, but engorged

examples were difficult to obtain during the transmission season. The fact that some species that are important vectors of malaria in other parts of the Oriental Region have been found to be markedly zoophilic may account for their comparative unimportance on tea estates in Assam and Bengal.

HICKS (E. P.) & DIWAN CHAND. **Transport and Control of** *Aëdes aegypti* **in Aeroplanes.**—*Rec. Malar. Surv. India* **6** no. 1 pp. 73–90, 2 figs., 1 map, 24 refs. Calcutta, March 1936.

The authors describe experiments carried out to determine the length of time that *Aëdes aegypti*, L., would survive in aeroplanes in flight. Females recently engorged with blood were placed in cages with a raisin for food in aeroplanes leaving the airport of Karachi. During August, 48 mosquitos in batches of 12 were despatched in Dutch liners. Of the first 36, 30 reached Amsterdam alive (a distance of 4,599 miles taking 2½ days), many were alive at Cairo on the return journey (6,809 miles ; 5 days) and 2 survived to pass through Karachi and arrive at Jodhpur (9,580 miles ; 6½ days). Of 45 control mosquitos, 42 survived for 7 days. To determine the frequency with which mosquitos are accidentally carried in aeroplanes, a search was made of 206 air liners arriving at Karachi airport between 15th June and 31st October 1935 ; no mosquitos were caught, and only one was seen. It is possible, however, that mosquitos were scarce or absent at the points of departure. Similar researches in other countries are summarised [*cf.* **20** 51, 149 ; **21** 183 ; **24** 65]. Observations on mosquitos in an apparatus used for testing altimeters indicate that *A. aegypti* is unaffected by exposure to reduced atmospheric pressure.

Details are given of experiments with Pyrocide 20 [**23** 301] as a spray-fumigant for aeroplanes. The results suggest that this pyrethrum extract is effective at the rate of 3 c.c. per 1,000 cu. ft. (diluted in the proportion of 1 : 20 with kerosene) with an exposure of 5 minutes for cabins and luggage rooms and of 15 minutes for less accessible spaces. A few tests indicated that the rate of mortality varied with the dose of Pyrocide and that the degree of dilution was of minor importance. The different rates of mortality in the four experiments in which the total volume of the mixture was varied seemed to be more closely related to changes in humidity, the spray being more effective when the air was drier.

Various suggestions are made for making aeroplanes mosquito-proof. Doors should fit closely, spaces under seats should be closed with sheet metal or 3-ply wood, ventilators should be covered with mosquito-proof wire gauze, apertures in wings and fuselage for control wires and other moving parts may be closed by loose-fitting fabric sleeves continuous with the fabric of the body, and openings designed to allow greasing or adjusting of interior structures may be closed by spring flaps, sliding shutters, or flaps of fabric held together by lightning fasteners. To allow passengers to alight without letting the mosquitos escape, the door of the aeroplane should open into a mosquito-proof cage [*cf.* **24** 66]. On the other hand, mosquito-proofing prevents the escape of any mosquitos that manage to enter the machine while it is in port, and it may be considered that this disadvantage outweighs the advantages.

The distribution of yellow fever in Africa is shown on a map, and the likelihood of infected examples of *A. aegypti* being carried to India by

aeroplane is discussed. It is concluded that there is little risk with aeroplanes from the Sudan, but that the danger with those from Nigeria is greater, and although it is unlikely that an aeroplane would fly through from Nigeria to India, it might be desirable to prohibit such flights.

SINTON (J. A.). **What Malaria costs India, Nationally, Socially and Economically.**—*Rec. Malar. Surv. India* **5** nos. 3–4 pp. 223–264, 413–489, 1 chart ; **6** no. 1 pp. 91–169, 10 pp. refs Calcutta, 1935–36.

Some of the more relevant observations on the problem of malaria in India have been collected from the literature and presented in this paper, with a view to stimulating the interest of the population in a disease that is sapping the vitality of the people and hampering the progress of the nation, and in the hope that the information may be of value to workers who have to present to the financial authorities the necessity, urgency and economic importance of anti-malarial measures. The first part of the paper deals with the effect of malaria on the natural increase of the population ; the second with its effect on health, vitality and physical development, and on social, intellectual and political progress ; and the third with the financial losses, both direct and indirect, that it causes, and with the economics of anti-malarial operations.

The following is taken from the author's general summary and conclusions :—Malaria in ordinary years is responsible, directly, for at least a million deaths each year, and is almost certainly responsible, indirectly, for an additional million. It is probable that at least 100 million persons suffer from the disease each year and, through its effects in lowering vitality, it is probably indirectly responsible for the morbidity of a further 25–75 million annually. The annual financial losses to the individual and the family alone have been calculated at not less than eighty million pounds ; and this is apart from the effects of the disease upon all aspects of the labour problem. It is not possible to estimate with any degree of accuracy the immensity of the direct and indirect losses, but there is little reason to doubt that they must run into countless millions of pounds sterling each year. From the Government's point of view the disease results not only in a decrease in revenue but in an increase in the cost of administration. It has been shown that widely planned anti-malarial operations are economic ; there is often a direct financial profit on money invested and certainly an indirect profit in the effects that such measures have on the prosperity of the community.

PAPERS NOTICED BY TITLE ONLY.

RICE (E. M.), DATTA (S. B.) & BELL (F. G.). **A Description of the Larva of** *Anopheles gigas* **var.** *baileyi*.—*Rec. Malar. Surv. India* **6** no. 1 pp. 27–30, 1 ref. Calcutta, March 1936.

MULLIGAN (H. W.) & PURI (I. M.). **Description of** *Anopheles* (*Anopheles*) *habibi* **n. sp. from Quetta, Baluchistan.**—*Rec. Malar. Surv. India* **6** no. 1 pp. 67–72, 1 pl., 3 refs. Calcutta, March 1936.

May (R. M.). **L'hexachloréthane dans la lutte contre les moustiques.**—*Bull. Soc. Path. exot.* **29** no. 3 pp. 336–342, 1 ref. Paris, 1936. [*Cf. R.A.E.*, B **24** 128.]

May (R. M.). **L'hexachloréthane dans la lutte contre les larves de moustiques.**—*C. R. Acad. Sci. Fr.* **202** no. 3 pp. 246–247, 1 ref. Paris, 1936. [*Cf. R.A.E.*, B **24** 128.]

Parrot (L.). **Notes sur les phlébotomes. XVIII. Sur la présence en Algérie de** *Phlebotomus ariasi* **Tonnoir et sur la spermathèque de cette espèce.**—*Arch. Inst. Pasteur Algérie* **14** no. 1 pp. 48–49, 7 refs. Algiers, March 1936.

Sergent (Ed.) & Sergent (Et.). **Fumier sans mouches** [containers for preventing flies from breeding in manure].—*Arch. Inst. Pasteur Algérie* **14** no. 1 pp. 69–71, 2 pls., 1 ref. Algiers, March 1936. [Translation: see *R.A.E.*, B **23** 12.]

Kröber (O.). **Einige Griechische Tabaniden.** [Some Greek Tabanids, including new species.]—*Acta Inst. Mus. zool. Univ. athen.* **1** no. 3 pp. 33–40, 1 pl. Athens, 1936.

Kröber (O.). **Bestimmungstabelle der Palaearktischen** *Chrysozona*-**Arten** (*Haematopota*). [Key to the Palaearctic Species of *Haematopota*.]—*Acta Inst. Mus. zool. Univ. athen.* **1** no. 3 pp. 43–52. Athens, 1936.

Ewing (H. E.). **The Identity and Variation of** *Pediculus humanus americanus*.—*Proc. helminth. Soc. Wash.* **3** no. 1 pp. 36–37. Washington, D.C., 21st January 1936.

Ewing (H. E.). **The Taxonomy of the Anopluran Genera** *Polyplax* **and** *Eremophthirius*, **including the Description of New Species.**—*Proc. biol. Soc. Wash.* **48** no. 38 pp. 201–210, 5 figs., 1 ref. Washington, D.C., 15th November 1935.

Thompson (G. B.). **The Parasites of British Birds and Mammals. VII. Records of Ixodoidea from Hedgehogs and their Nests. VIII. Some additional Records of Bat Parasites.**—*Ent. mon. Mag.* **72** nos. 864–865 pp. 116–118, 133–136, 5 refs. London, May–June 1936.

Cooley (R. A.). *Ornithodorus parkeri*, **a new Species on Rodents** [in Wyoming and Washington].—*Publ. Hlth Rep.* **51** no. 15 pp. 431–433, 1 pl. Washington, D.C., 10th April 1936.

Collins (B. J.). **A new Species of** *Anomiopsyllus* [*montanus* sp. n.] **from Montana (Siphonaptera).**—*Ent. News* **47** no. 5 pp. 128–130, 4 figs. Philadelphia, Pa, May 1936.

Schreiter (R.) & Shannon (R. C.). **Un nuevo interesante género y especie de una pulga del murciélago. (A new and remarkable Genus and Species of Bat Flea)** [*Maxilliopsylla lilloi* from Tucumán].—*Bol. Mus. Hist. nat. Univ. Tucumán* **1** no. 12 15 pp., 2 pls. Buenos Aires, 1927. [Recd. May 1936.]

Sergent (Et.). **Obtention d'un sérum actif contre le venin de scorpion.**—*C. R. Acad. Sci. Fr.* **202** no. 11 pp. 989–990. Paris, 1936.

Sinton (J. A.). **"Man-made" Malaria in India.**—*Indian med. Gaz.* **71** no. 4 pp. 181–187, 37 refs. Calcutta, April 1936.

The author reviews the ways in which the activities of man have increased the incidence of malaria in India, either by multiplying the breeding places of Anophelines, by introducing malaria carriers into a healthy community or susceptible persons into a malarious community, or by producing conditions leading to economic stress and a lowering of the resistance of the population. He suggests briefly the means by which such a state of affairs could be remedied or avoided, and concludes that appropriate legislation should be passed and enforced to prevent any further increase from these causes.

De Meillon (B.). *Anopheles funestus* **Giles and** *Anopheles leesoni* **Evans in Human Habitations and Outdoor Haunts.**—*Ann. trop. Med. Parasit.* **30** no. 1 pp. 1–2, 2 refs. Liverpool, 8th April 1936.

From October 1933 to February 1934 collections of adults of *Anopheles funestus*, Giles, and *A. leesoni*, Evans, were made both in dwellings and in the open at Tzaneen (northern Transvaal), to determine what part, if any, is played by the latter in the transmission of malaria. Only females containing almost fully developed eggs were dissected for evidence of malaria infection, and their identity was established by the examination of the eggs [*cf. R.A.E.*, B **22** 211]. Males were identified by means of their palps [*cf.* **21** 133]. A total of 281 females and 65 males of *A. funestus* was taken in dwellings ; 12 per cent. of the females showed gland infections and 3 per cent. stomach infections. Only 21 females and 20 males of this species were taken out of doors, and no infections were noted. A single female of *A. leesoni* was taken indoors and 15 females and 34 males out of doors, but none was infected. The numbers taken in outdoor haunts were small, owing to the difficulty of finding Anophelines in such places, which are numerous, very often inaccessible, and scattered over a wide area near breeding places. These findings confirm the absence of males of *A. leesoni* in dwellings [*cf.* **21** 133].

Shute (P. G.). **A Study of Laboratory-bred** *Anopheles maculipennis* **var.** *atroparvus*, **with special Reference to Egg-laying.**—*Ann. trop. Med. Parasit.* **30** no. 1 pp. 11–16, 1 diagr., 1 ref. Liverpool, 8th April 1936.

A genetically pure strain of *Anopheles maculipennis* var. *atroparvus*, van Thiel, has been maintained for two years in the laboratory at Epsom, England, and, provided that the temperature and humidity were those that obtain in summer, breeding continued throughout the winter months. Experiments to obtain information on the length of life and powers of oviposition of the females were carried out at a constant temperature of 75°F. at three different periods, 11th May to 9th July 1934, 5th September to 21st November 1934, and 22nd January to 14th April 1935. In the summer experiment 58 females laid 275 batches of eggs during 59 days and 10 per cent. of the batches failed to hatch ; in the autumn experiment 58 laid 252 batches during

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78 days and 13 per cent. failed to hatch ; and in the spring experiment 48 laid 206 batches during 82 days and only 3 per cent. failed to hatch. Thus, in spite of a constant temperature and a relatively high degree of humidity, the fecundity of the eggs varied at the different seasons. From dissections of females that died during the experiments, it would appear that all were fertilised.

Oviposition took place at night. The females were fertilised at any time of the day while they were resting on the roof or sides of the cage; pairing readily occurred in small confined spaces, even in a test tube. Females fed readily immediately after depositing eggs. In some cases those with ripe ovaries did not oviposit for 4–5 days, but they usually refused a blood-meal during this interval. Usually one meal was sufficient to bring about complete development of eggs and their deposition. Females that survived long enough to lay more than 10 batches produced approximately 2,500 eggs. Their spermathecae still contained spermatozoa.

DUKE (H. L.) **On the Power of** *Glossina morsitans* **and** *Glossina palpalis* **to transmit the Trypanosomes of the** *brucei* **Group.**—*Ann. trop. Med. Parasit.* **30** no. 1 pp. 37–38, 2 refs. Liverpool, 8th April 1936.

In further experiments at Entebbe, Uganda, to compare the power of *Glossina palpalis*, R.-D., and *G. morsitans*, Westw., to transmit trypanosomes of the *brucei* group [*cf. R.A.E.*, B **21** 134], the flies were fed in approximately equal numbers and at the same times on monkeys each infected with one of several strains of *Trypanosoma gambiense* and *T. rhodesiense* that were known to be transmissible by tsetse. Flies dying before the tenth day after the first infecting feed were discarded. Of 2,091 examples of *G. morsitans* and 2,854 of *G. palpalis*, 3·83 and 2·45 per cent. respectively contained flagellates. Analysis of the figures showed the difference to be significant. These results confirm the previous conclusion that *G. morsitans* is a more efficient vector of these trypanosomes than *G. palpalis*.

DUKE (H. L.) & MELLANBY (K.). **A Note on the Infectivity of** *Trypanosoma rhodesiense* **in the Crop of** *Glossina palpalis*.—*Ann. trop. Med. Parasit.* **30** no. 1 p. 39, 1 ref. Liverpool, 8th April 1936.

In the routine experiments with *Glossina palpalis*, R.-D., at Entebbe, Uganda, the flies were given infecting feeds of mammalian blood on the second and fourth day after emergence, and were subsequently nourished on fowls. Trypanosomes, together with mammalian red blood cells, were not uncommonly found in the crops of flies dissected at least 14 days after their infecting feed ; such flies usually died with their crops distended. The trypanosomes appeared to be unchanged in morphology and activity and were perhaps slightly more numerous than they were originally in the animal's blood. To determine whether they were still infective the crop contents (red cells and trypanosomes) of examples of flies that had fed on blood containing *Trypanosoma rhodesiense* were inoculated into rats. The three rats received the crop contents of one, two and one flies, 12–14, 10–12 and 11–13 days respectively after the infecting feeds, but none became infected.

De Meillon (B.), Evans (A. M.) & Leeson (H. S.). **The Characters of *Anopheles marshalli* Theobald and *A. marshalli* var. *pitchfordi* Giles in the Adult, Larval and Pupal Stages.**—*Ann. trop. Med. Parasit.* **30** no. 1 pp. 45–55, 5 figs., 15 refs. Liverpool, 8th April 1936.

As the result of an examination of further material, the authors give a comprehensive description of the larva, pupa and adults of both sexes of *Anopheles marshalli*, Theo., and of the characters distinguishing the female, pupa and larva of var. *pitchfordi*, Giles, and define the limits of variation of these forms in southern Africa. The typical form is found in Southern Rhodesia, the Transvaal, Natal and Zululand; var. *pitchfordi* is apparently a local variety from the neighbourhood of Eshowe, Zululand. A key is given for distinguishing *A. marshalli* from its varieties and from similar Ethiopian species of the group *Myzomyia*.

Patton (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. A Revision of the Genera of the Family Muscidae Testaceae Robineau-Desvoidy based on a Comparative Study of the Male and Female Terminalia. The Genus *Cordylobia* Grünberg (sens. lat.).**—*Ann. trop. Med. Parasit.* **30** no. 1 pp. 57–69, 8 figs., 10 refs. Liverpool, 8th April 1936.

From an examination of the male and female terminalia of *Cordylobia anthropophaga*, Grünb., *Elephantoloemus indicus*, Aust. [*R.A.E.*, B **19** 20], and *Neocordylobia roubaudi*, Villen [**17** 239], an illustration of the male terminalia of *Stasisia rodhaini*, Ged., and a third-instar larva of *Booponus intonsus*, Ald. [**11** 91], the author concludes that these species, which are the types of their respective genera, should all be referred to the genus *Cordylobia*. The larva of *C. roubaudi* is not known, but those of the other four species are dermal parasites and possess many features in common. The genus *Cordylobia* is re-defined and, as it closely resembles the genus *Auchmeromyia*, it is placed in the subfamily Auchmeromyinae [**23** 229].

Patton (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. A Revision of the Species of the Genus *Glossina* Wiedemann based on a Comparative Study of the Male and Female Terminalia.**—*Ann. trop. Med. Parasit.* **30** no. 1 pp. 71–89, 22 figs. Liverpool, 8th April 1936.

In the present paper, which is one of a series [*cf. R.A.E.*, B **24** 59], the author describes the male and female terminalia of *Glossina longipennis*, Corti [*cf.* **23** 11], *G. fusca*, Wlk., *G. fusca* var. *congolensis*, Newst. & Evans, *G. fuscipleuris*, Aust., *G. nigrofusca* Newst., *G. tabaniformis*, Westw., and *G. brevipalpis*, Newst., giving, at the same time, the salient characters necessary for their identification and short notes on their distribution, habits and importance. He also illustrates the antenna of the male of each species and depicts the characters of the peg of the second segment and the sensoria of the third segment.

The Warble Fly (Dressing of Cattle) Order of 1936.—*S.R.O.* 1936 no. 71, 4 pp. London, 31st January 1936. [Recd. June 1936.]

This Order, which applies to Scotland as well as England and Wales, renders compulsory the treatment of cattle visibly infested with

Hypoderma bovis, DeG., or *H. lineatum*, Villers, by one of two alternative methods. The first consists of the application of a derris dressing at intervals of 27–32 days, commencing each year between 15th and 22nd March or as soon thereafter as the maggots appear under the skins on the backs of the cattle and continuing as long as they continue to appear. The dressing must be prepared immediately before use by diluting with water a powder containing derris root so that each gallon contains 1½ oz. derris resins or ½ oz. rotenone and also 4 oz. soap, which may be added at the time of dilution or incorporated in the preparation in powder form. As the alternative treatment, the ripe maggots must be squeezed out from the backs of the infested cattle, or removed by other mechanical means, and effectively destroyed within the prescribed dates. No treatment will be required after 30th June in any year. Power is given to local authorities to grant exemptions in special cases, and provision is made for regulating the preparation and sale of dressings.

MERRILL (M. H.) & TENBROECK (C.). **The Transmission of Equine Encephalomyelitis Virus by** *Aëdes aegypti*.—*J. exp. Med.* **62** no. 5 pp. 687–695, 4 refs. Baltimore, Md, November 1935. [Recd. June 1936.]

Further experiments [*cf. R.A.E.*, B **22** 225 ; **23** 89 ; **24** 33] on the transmission of the eastern and western strains of equine encephalomyelitis by *Aëdes aegypti*, L., are described, together with the technique used in feeding the mosquitos.

The following is largely taken from the authors' summary : A period of 4–5 days must elapse after the mosquitos have fed on an infected guineapig or on brain containing the virus before they can transmit the virus of the western type. There was no indication that the virus was harmful to the mosquitos, for the death rate in infected lots was no higher than in controls. Repeated attempts to demonstrate the virus in the eggs from females known to be infected, or in larvae, pupae and adults derived from such eggs gave negative results. Larvae did not take up the virus when it was added to the water in which they were reared. Males were infected with the virus by feeding, but they did not transmit it to normal females, nor did they transmit it from infected to normal females. With one exception, experiments on the transmission of the virus of the eastern type gave negative results [*cf.* **24** 33]. Apparently this virus is incapable of penetrating the intestinal mucosa of the mosquito. If, however, it was inoculated into the body cavity of the mosquito by needle puncture, it persisted and the results of transmission experiments were positive. The experiment in which the western strain of the virus was passed from one lot of mosquitos to the next [*cf.* **23** 89 ; **24** 33] was discontinued after the 17th passage, when the virus was demonstrated in undiminished amounts.

FAULKNER (D. E.) & KINGSCOTE (A. A.). **Observations upon the Migrations and Pathogenesis of** *Gasterophilus* **Larvae.**—*J. Parasit.* **22** no. 2 p. 223. Baltimore, Md, April 1936.

As it is still uncertain how the larvae of *Gastrophilus* migrate from the buccal mucous membranes to the stomach, the authors record the finding of larvae in the lumen of the oesophagus and their absence

from the submucous and peri-oesophageal tissues of a horse. A number of the larger larvae in the stomach of this animal were identified as those of *G. intestinalis*, DeG. There was marked oedema in the gastric submucosa.

CANAVAN (W. P. N.). **Occurrence of Intestinal and Nasal Myiasis in Oklahoma.**—*J. Parasit.* **22** no. 2 pp. 228–229. Baltimore, Md, April 1936.

The author records two cases of intestinal myiasis in children in which 2 larvae and 56 pupae of *Stomoxys calcitrans*, L., and one larva of *Hermetia illucens*, L., respectively, were recovered, and one case of nasal myiasis in which 26 larvae and 13 pupae of *Cochliomyia hominivorax*, Coq., were extracted.

MORRIS (M. L.). *Demodex folliculorum* (*canis*), **its Diagnosis and Treatment.**—*J. Amer. vet. med. Ass.* **88** no. 4 pp. 460–467, 4 refs. Chicago, Ill., April 1936.

The author discusses the diagnosis and treatment of demodectic mange (caused by *Demodex canis*, Leydig) in dogs in the United States. Clinical reports on 86 cases from 12 States indicate that the disease is widespread and that it is more prevalent among dogs with short coats or under one year old. Treatment with a special oil solution containing rotenone, applied by massage to the skin, has given satisfactory results.

BOYNTON (W. H.), HERMS (W. B.), HOWELL (D. E.) & WOODS (G. W.). **Anaplasmosis Transmission by three Species of Ticks in California.** —*J. Amer. vet. med. Ass.* **88** no. 4 pp. 500–502, 3 refs. Chicago, Ill., April 1936.

The experiments described show that *Anaplasma marginale* can be transmitted from infected to healthy cattle by nymphs and adults of *Dermacentor venustus*, Banks (*andersoni*, Stiles) [*cf. R.A.E.*, B **21** 70], by larvae of *D. occidentalis*, Neum., derived from ticks that had engorged on infected animals as nymphs or adults, and by nymphs of *D. albipictus*, Pack.

PEARSON (J. F. W.). *Latrodectus geometricus* **Koch in Southern Florida.**—*Science* **83** no. 2161 pp. 522–523. New York, 29th May 1936.

Latrodectus geometricus, Koch, was recorded from southern Florida in September 1935, this being the first report of this spider from the eastern United States. It has since been taken in some numbers in Miami, and is possibly the dominant species of the genus in southern Florida. It is apparently less agressive than *L. mactans*, F., and is believed to be more active at night than by day. Bites attributed to *L. mactans* in this region may possibly have been caused by *L. geometricus*.

[Aluimov (A. Ya.).] **Алымов (А. Я.). Fièvre recurrente de Perse.** [*In Russian.*]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 54–67, 3 figs., 2 graphs, 27 refs. Moscow, 1935. (With a Summary in French.) [Recd. June 1936.]

Information on the Persian form of relapsing fever and its supposed vectors is briefly reviewed from the literature, and notes are given on personal observations on cases of this disease in a hospital in Teheran, chiefly in 1933. Of 7 patients, all of whom came from other districts in Persia, 6 had a history of tick-bite. The disease was transmitted to guineapigs and rabbits by inoculation with blood from the patients and spirochaetes were found in them, which is further evidence that the vector is a tick, since spirochaetes are not found in guineapigs infected with the louse-borne form of the disease.

During 1933, about 14,000 ticks were collected in different parts of Persia on domestic animals and in caravanserais and inhabited houses. The species found on the animals were chiefly Ixodids, but also included *Argas persicus*, Oken, and *Ornithodorus lahorensis*, Neum., whereas the tick that predominated in buildings was *O. papillipes*, Bir., or a related species, which was not taken on the animals. In transmission experiments with this species, infection was demonstrated by injecting suspensions into a guineapig and a rabbit but was not produced in guineapigs or man by the bites of the ticks. Inoculation of laboratory animals with a suspension of as many as 500 examples of *O. lahorensis* did not produce infection.

O. tholozani, Lab. & Megn., was not found by the author. A careful study of the ticks collected led him to conclude that the ticks recorded as *O. tholozani* by previous workers on Persian relapsing fever were sometimes *O. lahorensis* and sometimes *O. papillipes*.

Sergent (Edm.), Sergent (Et.) & Parrot (L.). **Insectes et maladies en Afrique du Nord.**—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 68–70. Moscow, 1935. (With a Summary in Russian.) [Recd. June 1936.]

This is a systematic list of insects and ticks that are known or probable vectors of disease in northern Africa, showing the diseases concerned.

[Klimentova (A. A.) & Perfil'ev (P. P.).] **Климентова (А. А.) и Перфильев (П. П.). Punaises, puces et tiques comme transporteurs du virus du typhus exanthématique dans les conditions expérimentales.** [*In Russian.*]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 71–88, 8 graphs, 42 refs. Moscow, 1935. (With a Summary in French.) [Recd. June 1936.]

The literature on epidemic and endemic typhus and the part played by various Arthropods in their transmission is reviewed, and an account is given of experiments on the preservation and transmission of the virus of epidemic typhus by fleas, ticks and *Cimex lectularius*, L. All these Arthropods were allowed to engorge 2 or 3 times on diseased guineapigs or patients at the period of maximum febrile reaction, and after certain intervals were placed on healthy guineapigs, or emulsified

and injected intraperitoneally into them. Between the feedings they were kept at 28–31°C. [82·4–87·8°F.].

Experiments with *C. lectularius* confirmed findings by Castaneda & Zinsser [*R.A.E.*, B **19** 117] that the virus can survive in bed-bugs for 10 days, typical infection being produced in guineapigs by emulsions of bugs prepared 1 and 10 days after the last infective meal, but not with emulsions prepared 15 or 20 days after. Negative or irregular results were obtained with emulsions prepared 2–5 days after the bugs had fed, which may indicate that the virus multiplies in the bug. The disease was not transmitted by the bugs in feeding.

Only a few tests were made with fleas and successful infection was obtained in one case only, by injecting an emulsion of 10 examples of *Leptopsylla segnis*, Schönh. (*musculi*, Dugès) prepared 24 hours after the fleas had fed twice on a diseased animal.

In experiments with *Ornithodorus lahorensis*, Neum., transmission was obtained both by bites and injection of an emulsion. The virus was preserved in the ticks for a period of up to 25 days and was then transmitted by biting. It appears, however, that the virus gradually weakens in the tick, as evidenced by a prolongation of the incubation period in guineapigs. The experiments with *Argas persicus*, Oken, consisted only in inoculations of emulsions, positive results being obtained in some cases. The virus was preserved in the ticks for 10 days.

[Buichkov (V. A.).] **Бычков (В. А.). Du rôle joué par les puces dans la conservation et la propagation du virus de la peste.** [*In Russian.*] —In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 89–128, 24 figs., 116 refs. Moscow, 1935. (With a Summary in French.) [Recd. June 1936.]

On the basis of an exhaustive review of the literature, the author concludes that the possibility of the infection with plague of the fleas that occur on most of the species of rodents found in the Russian Union has been proved. The bacilli can be preserved for a considerable time in the fleas and may be transmitted by them to healthy animals, but though individual fleas may live for a protracted period under laboratory conditions [*R.A.E.*, B **20** 248, etc.], most of those that occur in the nests of rodents do not live very long, especially if the surrounding temperature is high [*cf.* **21** 160 ; **24** 67]. Moreover, some of the fleas in the nests are destroyed by the rodents or predators, such as Staphylinids [**22** 122].

An investigation on the fleas of rodents in Transbaikalia and their relation to plague revealed 10 species and 6 hosts ; these are shown in a table giving details of the numbers and percentages of fleas taken. The morphological characters of each species of flea are discussed, and a detailed account is given of transmission experiments. The species used in these are not named, but the hosts with which they were commonly associated are indicated. They were allowed to feed on infected rodents during the peak of plague septicaemia, fed again on healthy guineapigs or wild rodents after 4–7 days, and were then dissected to test plague infection in them [*cf.* **17** 131 ; **21** 5]. Of the 393 fleas fed, 52, including all the species used, became infected, plague bacilli being numerous in the digestive tract or blocking the proventriculus. No disease was, however, transmitted to any of the animals,

on which 1–10 fleas fed at a time. This suggests that small numbers of fleas seldom infect an animal by biting, in spite of a rapid and intense increase of the plague bacilli in them. Negative results were also obtained when some of the unaffected guineapigs were again subjected to bites by infected fleas and 12–40 fleas were used per animal ; it is concluded that they had acquired immunity owing to the small amount of infection previously introduced into them. Active immunity may thus be acquired if the animal is repeatedly bitten by single infected fleas. As an example of such immunity, the author adduces the evidence of Ioff and Pokrovskaya, who, in June 1928, found a ground squirrel [*Citellus*] that remained healthy though it had 14 plague-infected fleas on it.

The author believes that man is only occasionally infected with plague by the fleas of rodents, since one infected flea seldom transmits the disease to an animal, many of the fleas do not feed on the diseased animals during the period of septicaemia and thus escape infection, and the generation of fleas that become infected in the nests of rodents dies out in less than a year. He considers the natural cycle of plague epizootics to be as follows : During the period preceding hibernation, some ground squirrels are infected with a slight form of plague, but they become weakened during hibernation so that the disease assumes a fatal form in early spring, when numbers of fleas appear in the burrows and become infected. The carcasses of the animals are rapidly destroyed by the larvae of *Lucilia* (as has been observed in the field), and the fleas remain in the nest. The empty burrows are used by young ground squirrels, which migrate from other burrows ; they are attacked by the fleas and become infected. They usually die outside the burrows, which causes the dissemination of the infection in the steppe through the fleas from them. At the same time, the immunisation of rodents by small batches of infected fleas takes place, and this, combined with the natural resistance of animals about to hibernate, produces the occurrence of the latent type of infection and links the cycle to that of the following year.

In view of the important part played by fleas in the spread of epizootics, special attention should be devoted to the species infesting human dwellings, particularly as the winter outbreaks of plague among mice, which congregate at that season in and near inhabited houses and in stacks, are continuations of the summer epizootics among ground squirrels. In a plague campaign the extermination of rodents is essential. Their control, however, should include the destruction of their ectoparasites, the best means being fumigation with chloropicrin [**15** 126].

[ÉPSHTEĬN (G. V.), SIL'VERS (I. L.) & ÉKZEMPLYARSKAYA (E. V.).] **Эпштейн (Г. В.), Сильверс (И. Л.) и Экземплярская (Е. В.). Rat Fleas as Carriers of experimental Pneumococcus Infection.** [*In Russian.*]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 129–137, 1 diagr., 1 pl., 8 refs. Moscow, 1935. (With a Summary in English.) [Recd. June 1936.] English translation in : *G. Batt. Immun.* **14** pp. 1099–1111, 3 figs., 7 refs. Torino, 1935.

In the course of investigations on the transmission of typhus by fleas, the authors found considerable numbers of lancet-shaped diplococci [*Diplococcus pneumoniae*] in sections of some of the fleas. Since

this suggested that fleas might transmit pneumococcus infection, and since there are no data on the relation of insects to the spread of this disease in man, special experiments were carried out in April 1934 with *Xenopsylla cheopis*, Roths., and *Ceratophyllus fasciatus*, Bosc. The fleas were fed repeatedly on guineapigs infected by injecting a suspension of pneumococcus type I, and subsequently on healthy animals. Diplococci morphologically identical with those used for the injections were found in the blood of these guineapigs 36–38 days after the fleas had fed on them. The incubation period was more protracted than in guineapigs infected by injection, the febrile symptoms only becoming apparent on the 19th or 20th day, and in one instance on the 30th. In the fleas that had fed on infected guineapigs the diplococci were chiefly localised in the proboscis, proventriculus, and stomach contents and on the surface of the intestinal epithelium, but frequently occurred also in the epithelial cells, Malpighian vessels and oviducts. None was found in the salivary glands. The number of the diplococci in sections of fleas increased with time, showing that they propagate intensively; they remained alive in the fleas for not less than 25 days.

[Épshteĭn (G. V.), Sil'vers (I. L.) & Ékzemplyarskaya (E. V.).] **Эпштейн (Г. В.), Сильверс (И. Л.) и Экземплярская (Е. В.). Bed-bugs as Carriers of experimental Pneumococcus Infection.** [*In Russian.*]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 138–144, 3 diagr. Moscow, 1935. (With a Summary in English.) [Recd. June 1936.]

Experiments on the transmission of pneumococcus infection by bed-bugs [*Cimex lectularius*, L.] were made in the same way as those with fleas [see preceding paper], but were carried out with pneumococcus type II as well as with type I. In all cases bugs from infected guineapigs transmitted the infection to healthy ones on which they were fed. Diplococci occurred in practically all bugs after the second feed on an infected animal and were invariably present in all after five feeds, being morphologically identical with the type injected into the guineapigs. They chiefly occurred in the stomach contents, but were also present in the epithelium of the stomach, intestines and Malpighian tubes. Pneumococci of type I multiplied more abundantly in the bugs than those of type II. In the case of the latter, the incubation period lasted 2–5 days when the animals were infected by injection and 10–67 days when they were infected by the bugs, death occurring after 2–30 and 30–85 days respectively. Guineapigs infected with type I by either method died much more quickly. The infection appeared to some extent pathogenic to the bugs themselves. No pneumococcus-like organisms were found in normal bugs.

[Olsuf'ev (N. G.) & Lelep (P. P.).] **Олсуфьев (Н. Г.) и Лелеп (П. П.). Ueber die Bedeutung der Bremsen bei der Verbreitung des Milzbrandes (Anthrax).** [On the Importance of Tabanids in the Spread of Anthrax.] [*In Russian.*]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 145–197, 9 figs., 10 diagr., 56 refs. Moscow, 1935. (With a Summary in German.) [Recd. June 1936.]

Epizootics of anthrax have occurred in Western Siberia in recent years, and an investigation was undertaken there in 1932, one of the

aims of which was to ascertain whether Tabanids transmit the disease. The literature on this question is reviewed, and a detailed account is given of the authors' own observations. Various species of Tabanids were often seen attempting to feed on carcasses of horses or cattle that had been dead for 1–2 days, and though, in the absence of circulation and blood pressure, they were unable to engorge, *Bacillus anthracis* was found on the proboscis of individuals taken on fresh carcasses. The Tabanids did not alight on decomposing carcasses or on those that had been skinned.

The time during which the Tabanids preserve the infection and the localisation of the anthrax bacilli in them were ascertained in special laboratory experiments. The technique is described, and the results are tabulated. The flies were placed on rabbits that had just died of anthrax and induced to feed on blood from a cut in the jugular vein by lightly sprinkling it with sugar. It was found that the bacilli were preserved for 5 days in the proboscis, and for 2 days in the crop and the stomach, but they did not penetrate into the salivary glands or haemolymph. They were not pathogenic to the Tabanids, and their virulence did not decrease either in the proboscis or when passing through the digestive tract. They were excreted for 2 days in the faeces.

In further experiments, the infection was transmitted to six rabbits and a horse by the feeding of Tabanids the probosces of which had been contaminated with an emulsion from the spleen of a mouse that had died of anthrax. In most of the animals, subcutaneous swellings were observed on the sites of the bites. The infection was transmitted irrespective of whether the flies had engorged on the blood of the animals or had merely bitten them, and it is probable that one fly can infect several animals, as, though some of the bacilli in the individuals used in the experiments passed into the stomach with the imbibed blood, a considerable number remained in the proboscis.

The authors believe that transmission of anthrax from a diseased animal by Tabanids cannot be very common, as the bacilli are numerous in it for only a few hours before its death, so that the period during which Tabanids can acquire infection is limited. Moreover, the flies can easily engorge completely on the dying animals, which are too weak to drive them away, and thus do not have to complete their feed on a healthy animal. Transmission from carcasses is much more likely to occur, as the Tabanids infect the proboscis and then have to feed on living animals to satisfy their hunger. Tabanids may also become infected from soil or water as certain species often satisfy their thirst from moist soil and mud at the bottom or edges of drying puddles, etc., where anthrax bacilli occur. Moreover, the Tabanids may carry the bacilli to uninfected accumulations of water and can also disseminate them by the deposition of excreta; observations showed that a Tabanid deposits faeces 15–20 times in 24 hours, and since the bacilli continue to be excreted for 2 days, an infected fly may leave the infection in 30–40 different places in the field, and thus create new foci.

The part played by Tabanids in the epizootics of anthrax in the Russian Union is discussed. From personal investigations and statistical data the authors believe that in certain northern areas, in which they are abundant, they may be responsible for 80 per cent. of the cases of anthrax infection among horses and cattle during the summer. In these areas, the peak of the epizootics coincides with the maximum abundance of Tabanids in the field, and the rate of infection of different

kinds of animals is in direct relation to the degree in which they are liable to the attacks of the flies, horses being preferred and suffering the most, cattle coming next, and sheep and pigs being but slightly attacked. Moreover the infection in horses and cattle is usually cutaneous and is accompanied by swellings localised in parts of the body that are most accessible to the flies. In the tundra, severe epizootics are caused among the reindeer. As the numbers of Tabanids decrease towards the south, anthrax infection among domestic animals becomes correspondingly more rare ; the fact that in the steppe zone the rate of infection among horses, cattle and sheep is approximately equal indicates that the disease there is chiefly acquired through grazing or drinking.

On the basis of these investigations, the authors conclude that in areas where Tabanids abound they should be considered the chief cause of the spread of anthrax. Diseased animals should therefore be immediately isolated in fly-proof buildings, carcasses should be sprayed with a disinfectant, such as carbolic acid, that will repel Tabanids, and healthy animals should be kept in closed buildings during the day and let out to graze only at night or during dull cool days, when the Tabanids are absent. Working horses and oxen should be treated with repellents, and the Tabanids should be controlled by all possible means.

[PETRISHCHEVA (P. A.).] **Петрищева (П. А.). Faune, biologie et écologie des phlébotomes de la Turkomanie.** [*In Russian.*]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 202–259, 8 figs., 1 fldg map, 4 diagr. (1 fldg), 2 graphs, 12 refs. Moscow, 1935. (With a Summary in French.) [Recd. June 1936.]

A detailed account is given of the distribution and seasonal occurrence in Turkmenistan of the 15 species of *Phlebotomus* that have been recorded there [*R.A.E.*, B **23** 74, etc.]. A list shows the wild mammals, reptiles and birds with which sandflies were associated, with particulars in each case as to the character of the habitat, the species of sandflies taken, and whether they had already engorged or did so later in the laboratory.

Practically all the species occurred up to an altitude of 3,000 ft., but *Phlebotomus kandelakii*, Shchur., was only present below 1,000 ft., and *P. wenyoni*, Adl., Thdr. & Lourie, and *P. pawlowskyi*, Perfil'ev, above 2,000. Above 3,000 ft. the number of species decreased with increasing altitude, and above 7,000 ft. only *P. sergenti*, Parrot, *P. minutus* var. *arpaklensis*, Perfil'ev, and *P. squamipleuris*, Newst., were found. Observations showed that when man occupies previously uninhabited regions, various species of *Phlebotomus* such as *P. papatasii*, Scop., *P. minutus*, Rond., *P. caucasicus*, Marz., and *P. sergenti* acquire domestic habits, finding favourable conditions for development, shelter and food in association with man and domestic animals [*cf. R.A.E.*, B **21** 98]. Other species, however, such as *P. wenyoni* and *P. pawlowskyi*, have remained strictly limited to wild biotopes. In isolated cases, conditions in caves and burrows permit sandflies to breed throughout the year. Thus, in the burrow of a porcupine, in which the temperature was never below 15°C. [59°F.], *P. papatasii*, *P. sergenti*, *P. minutus* and *P. caucasicus* continued to emerge throughout the winter, and in the burrows of rodents sandflies continued to develop throughout the summer [**23** 51]. The burrows of land tortoises and hedgehogs run

rather close to the surface of the soil and do not offer sufficient protection from the desiccating effect of the surrounding desert in summer. In outhouses near human dwellings, adult sandflies occurred from April to the end of October, being more numerous when the buildings were surrounded by green vegetation, especially from July onward.

All species of sandflies, except *P. pawlowskyi*, were attracted by artificial light ; they were most active between 9 p.m. and midnight.

Under natural conditions 5 mature larvae and 14 pupae of *Phlebotomus* were found, all occurring in almost dry substrata, in the burrows of animals, in dry excreta of small domestic animals, or among leaves or rubbish. Adults emerged from a burrow, a tree hole, under floor boards, etc. These observations indicated that sandflies choose as breeding places a great variety of biotopes, which may explain the difficulty in finding the immature stages in the open. In the laboratory the faeces of small animals proved to be the best breeding medium. Breeding was most successful when the medium was moistened with a few drops of water every other day for 18–20 days; under these conditions the cycle of development was completed in 36–38 days and 94–96 per cent. of the larvae produced adults.

MARTINI (E.). **Beitrag zur Kenntnis der Variabilität bei Culiciden.** [Contribution to the Knowledge of Variability in Mosquitos.]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 260–263. Moscow, 1935. (With a Summary in Russian.) [Recd. June 1936.]

The importance is emphasised of studying the variability of the morphological characters on which the identification of various species of insects is based. Though in many cases it is easier to distinguish between subspecies, races, etc., on the basis of their physiological and ecological peculiarities, for practical reasons the morphological characters usually have to be taken into consideration. In the classification of mosquitos the structure of the male hypopygium has been found of great importance. Species of *Anopheles* have been described in the past as new on the basis of the different numbers of spines on the first segment of the valves, but when the variability of this character has been studied, it has become clear that the new species were only abnormalities, or perhaps geographical races [*cf. R.A.E.*, B **21** 195]. Collections of mosquitos received by the author from Mexico represented ample material for the study of the variability of a series of characters. He found that in the genus *Psorophora*, individual species showed great variation in certain characters, including the number of spines on the claspette, though he was able to distinguish a hitherto undescribed species by the proportions of the segments of its legs.

[KADLETZ (N. A.) & KUZ'MINA (L.A.).] **Кадлец (Н. А.) и Кузьмина (Л. А.). The dispensary Method of Controlling Hibernating Anophelines under the Conditions of a large Town, its Value as compared with other Methods of Control.** [*In. Russian*]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 264–268, 1 ref. Moscow, 1935. (With a Summary in English.) [Recd. June 1936.]

Since the destruction of Anophelines in all their hibernation quarters in a large town is practically impossible, the authors suggest that the

destruction of those found hibernating in or near the dwellings of people infected with malaria may be of value in the control of the disease. This method was tried from October 1929 to May 1930 in the town of Kuĭbuishev (Samara), where 517 infected persons were found in a population of 200,000. Whenever a blood film proved positive, a doctor and entomologist were sent to the house, the patient and other persons in the vicinity were periodically treated with quinine, and mosquitos were destroyed in their hibernation quarters. The latter were found in 95 houses out of a total of 314. The greatest number of dwellings that contained 2 or more infected persons occurred in low-lying, flooded areas on the outskirts of the town, which indicates that the campaign should be carried out from the periphery to the centre. Of the hibernation quarters, 68 per cent. were cattle-sheds, cellars and outhouses, 20 per cent. basements, 8 per cent. corridors, boxrooms, etc., and 4 per cent. rooms occupied by infected persons.

To determine whether it is necessary to destroy Anophelines at some distance from an infected house to prevent them flying to it in spring, 800 over-wintered females were stained and liberated in a cellar in the spring of 1930 when the weather was sufficiently warm to keep the windows in the houses open. Various buildings, chiefly inhabited houses within a radius of 150 yards, were thoroughly inspected for the presence of the stained mosquitos for 20 days, during which period they gradually left the cellar. Only 4 stained mosquitos were captured, all of them engorged and taken in bedrooms above the cellar where the 800 were liberated. No unstained individuals were found in any of the houses. This experiment indicated that the overwintered females seldom enter dwellings, and only those nearest to the hibernation quarters. The destruction of mosquitos hibernating in proximity to infected houses should therefore break the link between infected persons and Anophelines in spring.

Up to the appearance of the adults of the first generation, no mosquitos were found in flats close to which batches of hibernating individuals had been destroyed, whereas in other houses engorged mosquitos were often present.

PATTON (W. S.). **Classification of the Myiasis-producing Diptera of Man and Animals.**—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 269–271. Moscow, 1935. (With a Summary in Russian.) [Recd. June 1936.]

The author divides the Diptera that cause myiasis into three main groups, of which the first comprises species that normally or always develop in living tissues of man or animals, the second, species that normally breed in decaying animal or vegetable matter but sometimes infest wounds or even uninjured surface tissue, and the third, species that may cause myiasis of the digestive tract if the eggs or larvae are accidentally swallowed with food.

The first group is further subdivided into flies, such as *Cordylobia anthropophaga*, Grünb., or *Dermatobia hominis*, Say, which do not oviposit on the host, those that deposit eggs or larvae in or near the tissues that the larvae infest, and such flies as Oestrids, which oviposit or larviposit on special parts of the body of the host so that the larvae subsequently gain access to particular tissues or organs, in which alone they can áttain full growth.

Natvig (L. R.). *Hypoderma lineatum* **als fakultativer Parasit eines norwegischen Mädchens.** [*H. lineatum* as a facultative Parasite of a Norwegian Girl.]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav.* 25*e Anniv. sci. Pavlovsky* 1909–34 pp. 272–274, 1 fig., 4 refs. Moscow, 1935. (With a Summary in Russian.) [Recd. June 1936.]

A case is recorded of the infestation of the face of a child in Norway by a larva of *Hypoderma lineatum*, Vill., which was in the fourth instar when removed. Subcutaneous infestation of man by *Hypoderma* is of common occurrence in Norway.

Hoare (C. A.). **The Development of Trypanosomes in Tsetse-flies in Relation to the Peritrophic Membrane.**—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav.* 25*e Anniv. sci. Pavlovsky* 1909–34 pp. 367–372, 2 figs., 9 refs. Moscow, 1935. (With a Summary in Russian.) [Recd. June 1936.]

The author reviews the literature on the course of development of various trypanosomes in *Glossina*, with particular reference to the influence of the peritrophic membrane [*cf. R.A.E.*, B **18** 203] on their migrations. *Trypanosoma grayi* passes from the endoperitrophic space of the mid-gut through the open end of the peritrophic membrane into the ectoperitrophic spaces of the hind-gut and mid-gut, and, finally, the metacyclic forms are gradually evacuated with the faeces [*cf.* **20** 19]. *T. brucei* and *T. gambiense* follow the same route until they reach the ectoperitrophic space of the mid-gut, when they move forward into the ectoperitrophic space of the proventriculus, and penetrate into the lumen of the proventriculus through the peritrophic membrane at the point where it is secreted in a fluid state by the epithelial ridge of the mid-gut. They then proceed forward into the proboscis, enter the hypopharynx at its open end and migrate backwards into the salivary glands, where they give rise to the infective metacyclic forms. The infective forms of *T. vivax* and *T. congolense* are produced in the proboscis of the fly, but the latter has been observed in the ectoperitrophic space of the mid-gut [*cf.* **18** 203]. In the case of *T. vivax* the trypanosomes that are taken into the gut are probably confined to its endoperitrophic space, where they gradually degenerate or are digested with the blood, so that only those that attach themselves in the proboscis undergo further development. *T. congolense* probably behaves in the same way as *T. brucei* and *T. gambiense*, except that it does not invade the salivary glands and therefore completes its development in the mouth-parts of the fly.

Messer (F. C.) & McClellan (R. H.). **Surgical Maggots. A Study of their Functions in Wound Healing.**—*J. Lab. clin. Med.* **20** no. 12 pp. 1219–1226, 4 figs., 14 refs. St Louis, Mo, September 1935.

Those who have observed the action of blowfly larvae in infected wounds agree in general that they decrease the bacterial population, remove necrotic tissue, and stimulate healing, but little is known of the means by which these effects are produced. The authors describe in detail the technique of experiments designed to determine the source of the changes in hydrogen-ion concentration that occur in wounds

treated with blowfly maggots and the mechanism by means of which the necrotic tissue is removed. In five operative wounds in cases of chronic osteomyelitis treated with maggots, it was found that the pH fluctuated widely in all but one, and that in every case at some time it reached an alkalinity greater than 7·4. In two open wounds of other natures not treated with maggots, the pH did not fluctuate so markedly nor did it extend above 7·4. In only two cases of chronic osteomyelitis out of eight was the maximum pH less than 7·4, and neither of these cases could be followed to complete healing. The fluctuations in pH followed roughly the clinical condition of the wound; progressive healthy healing was accompanied by a consistent increase in alkalinity, and failure to progress towards healing or an increase in exudate was followed by a marked fluctuation towards acidity. The increase of alkalinity beyond the reaction of blood plasma (pH 7·4) might arise from an abnormal reaction of body tissues to the presence of maggots or from the maggots themselves. As the latter are known to excrete ammonia [*cf. R.A.E.*, B **20** 162], the ammonia production of sterile larvae of *Lucilia sericata*, Mg., was measured quantitatively to determine whether the amount formed was sufficient to render the wounds alkaline to the degree observed. It was found that each maggot is capable of furnishing at least 0·1 mg. of ammonia nitrogen per day, and more towards the end of the larval stage. Usually at least 100–200 maggots are used in a wound dressing, which would furnish 10–20 mg. ammonia nitrogen daily. As 1 cc. of decinormal ammonium hydroxide solution containing 1·4 mg. ammonia nitrogen is capable of changing the reaction of 2 cc. blood serum over approximately 1 pH unit, the amount of ammonia furnished by maggots in the usual dressing would be sufficient to neutralise much of the acid exudate characteristic of inflammation and infection, and when the latter had to some degree subsided, to account for the excess alkalinity observed. Moreover, maggots in the presence of bacteria produce more ammonia than when they are sterile [*cf. loc. cit.*]. The slight excess of alkalinity would exert a definite inhibition of bacterial growth in the wound.

In England the larvae of *L. sericata* are reported to burrow through the skin of living sheep into the flesh. The American strain was chosen for surgical purposes because it has never been known to attack living tissue. To determine their proteolytic activities, extracts of sterile half-grown American larvae were tested against casein, gelatin and peptone, and the washings obtained from dipping larvae repeatedly in normal saline were tested against gelatin and peptone. The best agent for extracting the proteolytic enzymes was found to be 20 per cent. glycerol, and extracts made with this solvent proved to be highly proteolytic. On the other hand the washings showed a tryptic activity barely greater than the limits of error of the method. The use in a wound of an enzyme solution sufficiently powerful to hydrolyse the dead tissue completely would be highly irritating, and these experiments seem to show that the maggots excrete a fluid just strong enough to liquefy their food, but that the bulk of the digestion takes place within the digestive tract out of contact with the tissues of the wound. Moreover the proteolytic end-products, which would otherwise be absorbed by the system of the patient or remain in the wound to furnish a substratum for bacteria, are utilised in the development of the maggots and so rendered inert. A collagenase has been reported from the excreta of the larvae of *L. sericata* in England. As such an enzyme would aid the larva in penetrating the intact skin of an animal, and as

no such enzyme was identified in the present investigations, it is suggested that its absence may account for the difference in feeding habits of the American strain.

SIMMONS (S. W.). **A Bactericidal Principle in Excretions of Surgical Maggots which destroys important Etiological Agents of Pyogenic Infections.**—*J. Bact.* **30** no. 3 pp. 253–267, 16 refs. Baltimore, Md, September 1935. [Recd. June 1936.]

With a view to elucidating the question of the almost complete sterility obtained in wounds treated by means of blowfly larvae, investigations were undertaken on the natural elimination products of the living maggots of *Lucilia sericata*, Mg. The technique for collecting these by washing the larvae is described.

The following is taken largely from the author's summary: Bactericidal tests with the substance obtained were carried out with 7 species of bacteria of etiological importance in pyogenic infections. The results showed that an exposure of 5–10 minutes was usually sufficient to kill completely dense saline and broth suspensions of the organisms. The active principle appears to be non-viable and is not destroyed by autoclaving for 20 minutes at a pressure of 10 lb. No indication of lysis could be demonstrated, and its thermo-stability and other reactions eliminate the possibility of its being a bacteriophage. The material was desiccated, and in this dry condition it apparently maintained its potency over a longer period than when it was in aqueous solution. Its remarkable bactericidal potency against *Staphylococcus aureus*, haemolytic streptococci and *Clostridium welchii* partly accounts for the satisfactory results obtained when such infections are treated with maggots. Possibly other useful disinfectants might be obtained from living organisms.

GUNDERSON (M. F.). **Insects as Carriers of** *Clostridium botulinum*.—*J. Bact.* **30** no. 3 p. 333. Baltimore, Md, September 1935. [Recd. June 1936.]

Large areas of Tule Lake, California, are covered by a mat of *Cladophora* on the surface of which cocoons of the Hydrophilid water beetle, *Enochrus hamiltoni*, Horn, were found to be numerous. An epizootic of avian botulism (duck sickness), lasting for a week or ten days, occurred among sandpipers when the beetles were in the larval stage, and large numbers of the larvae were found in the stomachs of both infected and healthy birds. *Clostridium botulinum*, type C, was demonstrated in cultures made from the larvae and from the cocoons. When the beetles were in the pupal or adult stages and were no longer attractive or available, sandpipers did not represent any great proportion of the affected birds. The moist algal mass containing dead and putrefying larvae undoubtedly constituted the source of toxin for the sandpipers.

HOWARTH (J. A.). **The Prevention of Myiasis in Wounds of Domestic Animals by Use of "Bone Oil."**—*J. Amer. vet. med. Ass.* **88** no. 5 pp. 628–629. Chicago, Ill., May 1936.

In California during the summer and autumn of 1935, satisfactory results were obtained in protecting from blowflies wounds of various

types in cattle, sheep, horses and pigs by treating them with bone oil, a by-product in the manufacture of bone charcoal. This oil is a complex mixture of organic substances, and although the chemical contents of various lots are said to vary widely, its physical properties are sufficiently uniform for all practical purposes. It is a tar-like, semi-solid material, black, viscid, and extremely adhesive to skin and wound surfaces.

In experiments with wounds infested with various blowfly larvae, benzol was used for their destruction and removal, and bone-oil subsequently applied. In no case was the wound reinfested, and healing was rapid, showing that the bone oil had no detrimental effect on the tissues. In experiments to test its repellent action, legs of raw mutton were treated and left in sheep corrals where flies were abundant. Observations were made twice daily. Untreated meat was heavily infested with egg masses on the first day, whereas no eggs were found on the treated meat at the end of ten days.

Brown (A. W. A.). **Miscellaneous Physiological Observations on the Laboratory Breeding of Flesh Flies and of** *Melanoplus bivittatus* **Say.**—*Canad. Ent.* **68** no. 4 pp. 88–91, 6 refs. Orillia, April 1936.

An account is given of miscellaneous observations made during the rearing of *Wohlfahrtia vigil*, Wlk., *Calliphora erythrocephala*, Mg., and *Lucilia sericata*, Mg., including notes on pathological conditions brought about by exposure to certain temperatures and humidities, etc. The larvae of these flies burrow into meat in a solid rank or cluster; stragglers die, since alone they cannot excrete enough ammonia to liquify the meat [*cf. R.A.E.*, B **20** 162] and produce in it a reaction alkaline enough to allow the optimum operation of the larval trypsin, which passes out in active form in the excreta. Meat, especially blown meat placed at low temperatures, may become too putrescent to allow the growth of maggots. The putrefying bacteria can operate slowly at these temperatures, and putrefaction spreads to the larvae, manifesting itself in the larval stage or at pupation. Prepupae of *Lucilia* and *Calliphora* were placed in sawdust in two earthenware crocks. In the one closed with a lid all had pupated in 4 days. In the one left open only 5 per cent. had pupated 1 month and 7 days later. The sawdust had dried completely and the pupae and prepupae had become so small that they passed through a sieve that withheld all pupae in the other crock. This result is of interest in that other workers have reported that high humidity retards and low humidity accelerates pupation. Adult flies from such prepupae were extremely small, and it is suggested that delayed pupation may be one of the causes, in addition to larval food supply, of the variation in size in Muscoid flies.

Lamborn (W. A.). **The Annual Report of the Medical Entomologist for 1933.**—*Annu. med. Rep. Nyasaland* 1933 pp. 61–63. Zomba, 1934. [Recd. May 1936.] **The Annual Report of the Medical Entomologist for 1934.**—*Annu. med. Rep. Nyasaland* 1934 pp. 65–69, 5 refs. Zomba, 1935. [Recd. May 1936.]

In the first report, work carried out during the first 5½ months of 1933 only is reviewed, as the author proceeded on leave in late June.

A survey in certain parts of the Northern Province in May revealed the presence of a few examples of *Glossina* [*morsitans*, Westw.], but the position as a whole appeared to be satisfactory [*cf. R.A.E.*, B **22** 235]. In continuation of work on the possibility that Arthropods other than *Glossina* may be vectors of trypanosomes [*cf. loc. cit.*], attempts were made to transmit *Trypanosoma brucei* and *T. congolense* by means of *Musca sorbens*, Wied. (*spectanda*, Wied.), *M. tempestiva*, Fall., and an unidentified Muscid. The negative results obtained indicate that these flies are not responsible for cyclical or direct transmission of these trypanosomes. In the laboratory males of *Haematobia* (*Bdellolarynx*) *latifrons*, Malloch, lived 10–25 days and females 10–29, periods sufficiently long to permit the development of trypanosomes. Both sexes fed more voraciously than any other blood-sucking fly, except *Glossina* and, possibly, *Stomoxys*. Two experiments on the cyclical transmission of *T. brucei* and *T. congolense*, respectively, from cattle to rats by this fly gave negative results.

In the second report an account is given of work done during the year 1934. Surveys were carried out in May and December in various localities in the Northern Province, but again few tsetse flies were found and the position in these regions remained satisfactory. Observations were also made in the fly area bordering the Lake in the Dowa District to determine the position regarding fly in the neighbourhood of the railhead and the projected township at Salima, and to form some conclusion as to whether it is likely to be spread by rail to the uplands of the Ncheu District, or by motor vehicles along the road to Lilongwe. The flies were numerous, and as the contact between man and fly was likely to be increased by the railway and settlement schemes then developing, grass burning at a favourable season was recommended as a preliminary to settlement and clearing. A large acreage in this area is to be used for cotton, and as a marked reduction in the numbers of fly occurred some years ago when cotton was grown on a much smaller area in the same region, it is believed that agricultural development alone will greatly reduce the danger. The fly will undoubtedly be carried by the railway, but large tracts of the country traversed have long been infested, and the chances of its reaching the uplands is remote, as there are large intervening stretches of open country interspersed with woodland that harbour neither fly nor game. The spread of the fly along the new road is improbable, for in addition to the change in climatic conditions, due to an increase in altitude, which is likely to prove unfavourable, the bush is scanty for the last 30 miles and does not provide at any season the shade conditions on which the fly seems to depend.

Work with J. G. Thomson on the mechanical transmission of pathogenic protozoa by non-biting haematophagous Muscids has already been noticed [**22** 214]. In experiments to determine whether *Leishmania donovani*, *L. tropica* and *L. infantum* (dog strain) can undergo cyclical development in such flies, reared examples of *Musca sorbens* were fed on cultures of the flagellates and allowed to feed after various intervals at scratches on the ears of dogs, or at the inner canthus of the eye of a dog. Negative results were obtained in these and in other similar experiments with *L. donovani* and *L. tropica* and an undetermined species of haematophagous Muscid. This outcome was not unexpected, as *Leishmania* does not occur in cultures in the resting form in which it must normally be ingested by an insect vector.

A preliminary account of experiments to ascertain to what extent *M. sorbens* is capable of ingesting and passing *Bacillus leprae* has already been noticed [**23** 226]. In the course of further work acid-fast bacilli were found in excreta passed on the 13th day after the flies had fed on a leprous sore in its natural state, in a vomit spot obtained after 8 hours, and in the remains of 7 out of 19 drops of blood on which single flies had fed 5 hours after feeding on a leprous sore. The house-fly of the temperate zones [*Musca domestica*, L.] and the domestic form of the African Tropics, *M. domestica vicina*, Macq., do not habitually feed on sores, and in catches of Muscids made in houses and kitchens species of the *domestica* group predominated, whereas in those made at the same time from the backs of natives nearby and from their sores, *M. sorbens* was by far the most prevalent.

Austin (T. A.) & Mayne (L. C.). **A Review of the Incidence of Amoebiasis in Zomba, with Special Reference to European Cases.**— *Annu. med. Rep. Nyasald* 1934 pp. 73–82, 5 refs. Zomba, 1935. [Recd. May 1936.]

In the course of this account of investigations on amoebic dysentery in Zomba, where it has been endemic for many years, an extract is given from a report by W. A. Lamborn on his survey of the breeding places of domestic flies in the township begun in September 1934. The species of *Musca* found were *M. domestica*, L., breeding most abundantly in fermenting vegetable matter and human excreta, *M. ventrosa*, Wied., and *M. domestica vicina*, Macq., breeding in fowl manure, and *M. sorbens*, Wied. (*spectanda*, Wied.). Breeding was considerable in the vicinity of latrines and in rubbish pits and dumps within the town. The native habit of promiscuous defaecation, even when latrines are provided, is partly responsible for the large numbers of flies, but another important factor appears to be the inadequate disposal of night soil from native latrines; this is buried in the immediate vicinity of latrines, usually under such a scanty covering of earth that it is possible to discover fly larvae by stirring the surface. The system now being inaugurated, in which such material will be collected and dumped in pits 20 feet deep covered in except for a small opening at the top, which is proofed against flies, will probably provide as good a measure of fly control as is possible until the time when a water-flushing system can be installed in all houses.

Wanson (M.). **Note sur un poisson culiciphage du Bas-Congo.**— *Ann. Soc. belge Méd. trop.* **16** no. 1 pp. 153–158, 1 fig., 4 refs. Brussels, March 1936.

In the course of oiling of brackish pools and marshes on the peninsula of Banana [*cf. R.A.E.*, B **24** 107], it was found that one of the pools, which was connected at high tide with the creek, was full of small fish and remained free from mosquito larvae throughout the hot season. Tests in an aquarium with the four species of fish taken in this pool showed that the young of *Tilapia heudeloti* can devour large numbers of mosquito larvae. With a view to utilising this fish as a means of control, particularly for Anopheline larvae, further experiments were undertaken to determine its ability to withstand the high variation in salt content to which pools in this region are subject

(the salinity during 1934 varied from 0·90 to 72·07 gm. chlorides per litre). In March 1934 about 200 young fish of this species, measuring about 2–3 cm., were introduced into a pool in the interior of the peninsula, which was fed by rains and by seepages from the soil at high tides. No further oiling was carried out, but mosquito larvae were only found three times and then in small numbers. From a similar pool used as a control large numbers of larvae were collected each week, in spite of the fact that it was regularly oiled. The experiment was terminated on 15th July when the pools were dried up. Subsequently the fish were introduced into nearly all pools with equal success. They appear to tolerate the conditions in these pools and are able to reproduce, but they die in large numbers when the salinity reaches 38 gm. per litre. Anopheline larvae are capable of completing their life-cycle at higher salinities, though when the concentration reached 45 gm. per litre, their development was greatly retarded and all died at the end of 35 days.

Tilapia is found in running water ; it occurs naturally at the mouth of the Congo and is adapted to salinities of 9–15 gm. per litre (creek water). Although never found in the sea, it is readily adapted to a salt concentration of 23 gm. which is equivalent to that of sea water. An individual can destroy 110–152 larvae daily at concentrations below 25 gm., or 50 at 35 gm. Larvae and pupae of all kinds of mosquitos are devoured. The most suitable temperature is 28°C. [82·4°F.]. The fry are only able to ingest small larvae of the first or second instars ; the adult fish seek larger prey than mosquito larvae and in their absence may attack their own young. At Banana the marshes and pools were easily stocked with the fish at any time during the rainy season by means of a system of small canals communicating with the creek through a sluice gate in the main canal. Unfortunately the fish die during the dry season when the salinity becomes too high. The removal of grass, algae and water plants enables the fish to reach the larvae more easily.

[Yakimov (V. L.).] Yakimoff (W. L.) & Mizkewitsch (W. J.). **Sur la question de la répartition géographique des piroplasmes des bovidés en Russie.**—*Ann. Soc. belge Méd. trop.* **16** no. 1 pp. 161–162. Brussels, March 1936.

The authors record the presence of *Piroplasma berbera* (*Françaiella caucasica*) and *P. bigeminum* in cattle in the region of Voronezh. Nothing is known about the incidence of the possible vectors of the latter in this region, but the former is known to be transmitted by *Ixodes ricinus*, L., which is present. It is suggested that *P. bigeminum* is not indigenous, but that it is found in animals imported from parts of Russia, such as the North Caucasus, where it is already known to occur. The distribution of the five parasites that cause piroplasmosis of cattle in different parts of the Russian Union is very briefly reviewed.

Sundar Rao (S.). **Filariasis in Patnagarh (Orissa Feudatory State).**—*Indian J. med. Res.* **23** no. 4 pp. 871–879, 1 map, 3 refs. Calcutta, April 1936.

In February 1933 a filariasis survey was carried out in the town of Patnagarh, Orissa, where the incidence of the disease is high. The

parasite was found to be *Filaria malayi*, and the mosquitos recorded were *Mansonia annulifera*, Theo., *M. uniformis*, Theo., *Culex fatigans*, Wied., *C. pallidothorax*, Theo., and four species of *Anopheles*. Dissection of a large number of mosquitos collected in dwellings in different parts of the town showed that the first two species only were infected (23 out of 110 and 1 out of 23 respectively), and, as *M. annulifera* is the commonest mosquito, it is probably the chief vector. The species of *Mansonia* breed in the large reservoirs densely covered with *Pistia* that occur in the area surrounding the town.

SHORTT (H. E.). **Life-history and Morphology of** *Babesia canis* **in the Dog-tick** *Rhipicephalus sanguineus*. **Parts I–II.**—*Indian J. med. Res.* **23** no. 4 pp. 885–920, 9 pls., 2 figs., 17 refs. Calcutta, April 1936.

A very detailed account is given of the biology and morphology of *Piroplasma* (*Babesia*) *canis* in *Rhipicephalus sanguineus*, Latr., which is the vector in India, based on microscopical examination of serial sections of all stages of infected ticks. The infection can be transmitted from one stage of the tick to the next and from the adult through the egg to larvae of the next generation. The results confirm to a large extent the earlier work of Christophers (1907) and differ only in certain details from the life-history of this parasite in *Dermacentor reticulatus*, F. [*R.A.E.*, B **21** 76]. The earlier stages of development were found to take place in certain phagocytic cells in the body cavity and not in the cells of the gut [*cf. loc. cit.*]. It is possible that both findings are correct since the present study dealt with a different species of tick and chiefly with the nymphal instead of the adult stage. The parasites were subsequently observed to migrate to the muscles and muscle sheaths, where they concentrated, and later, when the nymphs had moulted, to invade the salivary glands of the adults, but this may also have been due to the difference in the species of tick. The sequence of events must be different, at least at some stages, since in ticks fed as nymphs the parasites ultimately reach the muscles and muscle sheaths, whereas in those fed as adults they accumulate in the ova.

COVELL (G.) & MEHTA (D. R.). **Studies on Typhus in the Simla Hills. Part IV. The Rôle of the Rat Flea in the Transmission of Typhus.** —*Indian J. med. Res.* **23** no. 4 pp. 921–927, 1 chart, 15 refs. Calcutta, April 1936.

In September 1935 a suspension of 121 examples of *Xenopsylla cheopis*, Roths., and 2 examples of *Ceratophyllus* sp. collected from 15 wild rats was injected into a guineapig. A strain of typhus isolated from this animal and subsequently maintained in guineapigs by inoculation [*cf. R.A.E.*, B **24** 105] produced reactions in these animals and in rats similar to those produced by a strain isolated from wild rats, and, except in one instance, cross-immunity tests were positive. The sera of rats infected with the flea strain in most cases gave positive results with *Bacillus proteus* OX19 but not with OXK or OX2. Typical intracellular rickettsiae were repeatedly observed.

Fleas (*X. cheopis* collected from wild rats) fed for 3 days on a rat infected with the wild rat strain of typhus failed to transmit the disease to a second rat after feeding for 3 days, but transmitted it to

a third rat after feeding for 9 days. The clinical and serological reactions produced in guineapigs and rats after passage through the rat flea were identical with those produced by the parent strain. The substrain exhibited cross immunity with the parent strain and with the strain originally derived from fleas. Rickettsiae were observed in one out of three fleas fed on an infected rat for 3 days, in large numbers in three fleas fed for 5 days, and in enormous numbers in a flea fed for 3 days 35 days previously. Thus it appears that the wild rat is a reservoir of typhus in the Simla Hills, that the virus is present in rat fleas under natural conditions, that it can be transmitted experimentally by means of fleas from rat to rat, and that it multiplies in the flea.

It has been noted in a previous paper [*loc. cit.*] that cases of typhus (XK type) have been observed in the Simla Hills in each of the last four years a few weeks after the end of the rainy season. It is at that time of the year that fleas are especially prevalent. In 1935 the rainy season began and ended some three weeks later than usual, the increased prevalence of fleas was also later, and the few definitely proved cases of typhus all had their onset between 13th and 21st September, whereas in 1933 and 1934 the first cases occurred during the last few days of August. Data on the incidence of fleas on wild rats in 1935 showed that the numbers of *X. cheopis* began to increase after 16th August and reached their maximum on 13th September. There is no evidence to show that the disease is prevalent among outdoor workers, and it is perhaps significant that 4 out of the 7 cases in 1935 were cooks.

SHRIMPTON (E. A. G.). **A Survey of the Incidence of Relapsing Fever in China.**—*Chin. med. J.* **50** Suppl. 1 pp. 312–344, 6 figs., 25 refs. Peiping, February 1936.

The geographical, climatic and seasonal distribution of relapsing fever in China, and its incidence according to occupation, sex and age, are discussed. Evidence indicates that seasonal variation is dependent on the behaviour of the louse [*Pediculus humanus*, L.], which is the vector [*cf. R.A.E.*, B **21** 51], in relation to the clothing habits of the people [*cf.* **8** 81]. It has been shown that the temperature of the skin varies for different parts of the body, being highest at the waist and decreasing towards the extremities. The louse is reported to be very sensitive to temperature, its optimum range being 30–32°C. [86–89·6°F.], the comfortable waist temperature. Above this range it becomes very active in its endeavours to find its preferred environment. It is probable that during very cold winters in the central and northern provinces, this temperature is difficult to maintain, and the louse becomes less active. On the other hand, in warmer weather the microclimate of the host is favourable for its rapid propagation ; and when the temperature of the body is raised by exercise, it migrates to the outer layers of clothing and may then be transferred with ease from one person to another. When winter garments are discarded, the lice are forced to migrate. Moreover, the body temperature of a person infected with relapsing fever normally rises to 40°C. [104°F.], the skin temperature being some 5°C. [9°F.] lower ; these conditions are most unfavourable, and the lice are most active in seeking a more suitable environment.

Feng (Lan-chou). **The Development of** *Microfilaria malayi* **in** *A. hyrcanus* **var.** *sinensis* **Wied.**—*Chin. med. J.* **50** Suppl. 1 pp. 345–367, 4 pls., 1 fig., 2 charts, 20 refs. Peiping, February 1936.

The author describes the various stages of development and the structural changes of *Filaria* (*Microfilaria*) *malayi* in *Anopheles hyrcanus* var. *sinensis*, Wied., which has been found to be a suitable host in China [*cf. R.A.E.*, B **23** 289]. At 29–32°C. [84·2–89·6°F.] the microfilariae shed their sheaths and begin to leave the stomach and appear in the body cavity of the mosquito about 3 hours after the infecting meal. The migration from the stomach to the thoracic muscle is completed in about 10 hours. Approximately 6–6½ days later the larvae reach maturity and migrate to the labium and other parts of the body, such as the palpi, antennae, legs and abdomen.

Hu (S. M. K.) & Yu (H.). **Preliminary Studies on the Blood Preferences of** *Anopheles hyrcanus* **var.** *sinensis* **Wiedemann in Shanghai Region.**—*Chin. med. J.* **50** Suppl. 1 pp. 379–386, 16 refs. Peiping, February 1936.

The experiment described is the first of a series of observations on the zoophilism of *Anopheles hyrcanus* var. *sinensis*, Wied., in the Shanghai region. Engorged mosquitos collected from a cow-shed were kept for 8 days in order that the blood might be completely digested, and 700 were then enclosed overnight in a room with a man, buffalo, pig, goat, cat, dog, 6 fowls and 6 ducks. The blood from the stomach of each of 500 of the 687 mosquitos that engorged was tested against precipitin sera prepared from the blood sera of cow, goat, pig, man, cat, dog and fowl, and the percentages positive were 47·6, 25·0, 13·8, 4·8, 3·4, 3·6 and 1·8 respectively. The relative amount of feeding surface is not a predominant factor in the choice of host, for a larger number of mosquitos fed on the goat, which was smaller and more hairy than the pig.

Treillard (M.). **La biologie des espèces anophéliennes du groupe** *minimus-funestus* **et son utilisation pratique. A propos de recéntes expériences.**—*Bull. Soc. Path. exot.* **29** no. 4 pp. 396–402, 12 refs. Paris, 1936.

The author discusses the successful results in the control of malaria in South Africa that have been obtained by spraying against adult Anophelines in houses [*cf. R.A.E.*, B **24** 77, 153, etc.] and gives his reasons for supposing that measures in houses would be effective against *Anopheles minimus*, Theo., in Indo-China [*cf.* **23** 81, 231].

Li (Feng-swen) & Wu (Shih-cheng). **Breeding Places of the Mosquitoes in Hangchow.**—*Yearb. Bur. Ent. Hangchow* **4** (1934) pp. 33–46, 21 figs., 2 fldg tables. Hangchow, 1935. **Notes on the Morphology of Culicine Larvae in Hangchow.**—*T.c.* pp. 95–120, 108 figs.

In the first paper, a list is given of the 32 species of mosquitos that have now been found in Hangchow [*cf. R.A.E.*, B **23** 153], of which 4 are Anophelines [*cf.* **22** 7]. In 1933–35, 1,597 collections comprising 21,962 larvae were made, and tables are given showing the distribution of the species in jungle, mountain and lowland areas,

the percentage of the different species taken in particular types of breeding places, the average number of larvae per dip in these breeding places, and the extent to which different species occurred in association.

In the second paper descriptions are given of the larvae of 19 of the species of Culicines that occur in Hangchow.

VOLLMER (O.). **Kleiner Beitrag zur Kenntnis der Verbreitung der** *Anopheles* **im Rheinland.** [A small Contribution to the Knowledge of the Distribution of *Anopheles* in the Rhineland.]—*Arch. Schiffs- u. Tropenhyg.* **40** no. 6 pp. 255–259, 1 map. Leipzig, June 1936.

Records are tabulated of findings of *Anopheles maculipennis*, Mg. vars. *maculipennis* (*typicus*), *atroparvus*, van Thiel, and *messeae*, Flni., in animal quarters and cellars in 35 farms not far from the Rhine from the north of Cologne to Cleves and Emmerich. During collections in September–October 1933, March, October and November 1934 and October 1935, this species was very rare, the total number of individuals taken being only 506. Finds indicating an increase of *atroparvus* and decrease of *messeae* with an increase in distance from the marshes of the lowlands were negatived by later finds in the hilly region east of Düsseldorf, where *messeae* sometimes predominated.

WILSON (D. B.). **Report of the Malaria Unit, Tanga, 1933–34 together with a Report on a Study of Malaria in India.**—Fol., 71 pp., 16 figs., 4 maps, many refs. Dar-es-Salaam, 1936. Price 10*s*.

The author points out that anti-malaria measures cannot be applied from a general knowledge of the natural laws of malaria, but only from precise data on conditions found in the locality in question, and that in very few cases is such information available. A study of locally relevant facts has led to a considerable degree of economy, and to a correspondingly greater degree of success, in anti-malaria work in various parts of the world. In all communities suffering from malaria, it appears necessary to ascertain to what degree chronic parasitism following clinical recovery from the effects of repeated infection is harmful to the health of the children and adults concerned, and to obtain accurate information on the economic loss caused by the disease, so that the economic practicability of applying control measures may be determined. To obtain such data for different types of urban and rural communities in Tanganyika Territory, investigations were carried out during 1933–34 in the town of Tanga, in a number of rural areas in Tanga Province, and at two localities in the Northern Province. The results are given in detail in this paper. An account of the work in some of the rural areas has already been noticed [*R.A.E.*, B **24** 141]. Data from the urban area of Tanga, where Anophelines are scarce, supplement those already obtained from Dar-es-Salaam [*cf.* **23** 234], where Anophelines are common.

In all the areas investigated, the most important vector is *Anopheles gambiae*, Giles. To be suitable for the breeding of this species, water must be fully exposed to the sun for part of the day (there seems to be no natural water in which the temperature is too high), it must be very slow-moving or motionless, it may be clear or muddy, but it must be free from pollution by decaying organic matter. The larvae

of *A. gambiae* are difficult to distinguish; they vary in colour from black to green, depending on their environment, but attempts to correlate variations in pigmentation and more strictly morphological characters with variations occurring in the adult have so far been unsuccessful. Of 4,050 adult Anophelines found in houses 3,476 were *A. gambiae*. In most of the places investigated this proportion varied little. In dissections of salivary glands 9·03 per cent. of this species were infected, but this rate varied considerably in different places and at different times of the year. Changes in infectivity, which cannot be wholly explained by variations in human infectivity [*cf.* **24** 142], may be due to racial or varietal differences in the mosquito or to differences in eco-climates. The sporozoite rate appears to be higher near the coast (13·8 per cent.) than inland (6 per cent.). Larvae of *A. funestus*, Giles, are often associated with those of *A. gambiae*, but they shelter beneath vegetation out of the sunlight; their scarcity in the areas investigated is probably due largely to the lack of suitable breeding places. Of the adult Anophelines caught in houses, 13·4 per cent. were those of *A. funestus*. The sporozoite rate in 220 examples dissected was 5·5 per cent. Other Anophelines caught in houses were *A. coustani*, Lav., *A. maculipalpis*, Giles, and *A. wilsoni*, Evans (once each), *A. demeilloni*, Evans (5 times) and *A. rhodesiensis*, Theo. (65 times). *A. rhodesiensis* was only caught in one locality, where it was quite domestic. The numbers that enter houses must, however, be but a small proportion of the whole population and none of those dissected was infected.

The presence or absence of smoke produced by cooking had no effect on the numbers of Anophelines caught, the average numbers for the houses with or without separate huts for cooking being the same. Day-time resting places, in order of preference, were clothes or other hangings, the legs of beds, the lower part of walls, the roof, and the upper part of walls. From many observations it is concluded that there is no movement of Anophelines after daybreak, and preliminary experiments indicate that they are active during the latter part of the night as well as in the earlier hours after dark. Feeding may occur in the open, although the house is the more usual site. In the case of two villages, the range of flight of females to and from their breeding places during the dry season was about one mile. A list is given of the non-domestic species of Anophelines, together with the characteristics of their breeding places and their distribution. From an examination at Tanga of a number of old trees and plants, such as *Canna* and pineapple, that contained water (or a fluid resembling water), it is concluded that this type of breeding place can be ignored in practical Anopheline control in the coastal area. On the other hand, large numbers of Culicines were found in pit latrines, which are believed to be their main breeding place in Tanga.

Since observations indicate that only *A. gambiae* and *A. funestus* are of importance in the transmission of malaria, at least in the coastal area, the institution of "species control" is advocated. The consequent reduction in cost would enable the controlled area to be extended. Moreover, this method is the only one that might be economically practicable outside the larger towns. Considerable specialised knowledge is required for its application, and a suggestion is made for the organisation of the necessary anti-malaria unit. The main object of treatment among natives should be the control of severe malaria in children under three years old.

In an appendix the author discusses briefly the problem of malaria and its control in India, from observations made during a visit to that country. The species of Anophelines associated with transmission in various regions are mentioned.

Dallas (E. D.). **Otro caso de dermitis extendida, producida por un lepidóptero y notas sobre** *Hylesia nigricans* **Berg. (Lep. Bombycidae).** [Another case of Dermatitis due to a Lepidopteron and Notes on *H. nigricans*.]—8. *Reun. Soc. argent. Pat. reg. Norte, Santiago del Estero* 1933, ii pp. 469–474, 2 figs., 1 ref. Buenos Aires, 1936.

Jörg (M. E.). **Nota previa sobre el principio activo urticante de** *Hylesia nigricans* **(Lepidoptera, Hemileucidae) y las dermitis provocadas por el mismo.** [A preliminary Note on the active urticating Principle of *H. nigricans* and the Dermatitis caused by it.]—*T.c.* pp. 482–495, 4 figs., 8 refs.

The first paper records two cases of dermatitis in Argentina due to contact with adults of the Saturniid, *Hylesia nigricans*, Berg, and mentions a case caused by a species of *Hylesia* in French Guiana, where this dermatitis is common [*R.A.E.*, B **21** 63; **24** 13]. The Argentine species of the genus are listed with a brief note on the biology of *H. nigricans*, which has one generation a year, the larvae occurring on a variety of trees.

The author of the second paper finds that the dermatitis is caused by contact with the abdominal hairs and spines of the female of *H. nigricans* or the layer of hairs that it leaves as a cover over a batch of eggs. The nature of the dermatitis is discussed, and an account is given of experiments showing that the hairs contain a toxic substance that is the causal agent.

Dallas (E. D.). **Primeras observaciones de dermitis ocasionadas por** *Paederus*, **(Col.), en la R. Argentina.** [First Observations on Dermatitis due to *Paederus* in Argentina.]—8. *Reun. Soc. argent. Pat. reg. Norte, Santiago del Estero* 1933, ii pp. 475–478, 6 refs. Buenos Aires, 1936.

Particulars are given of some cases of dermatitis in Argentina caused by Staphylinids of the genus *Paederus* [*cf. R.A.E.*, B **23** 177], the species concerned being *P. brasiliensis*, Er., and *P. ferus*, Er.

Kohls (G. M.) & Cooley (R. A.). **Notes on the Occurrence and Host Relationships of the Tick** *Ornithodorus talaje* **in Arizona.**—*Publ. Hlth Rep.* **51** no. 17 pp. 512–513, 6 refs. Washington, D.C., 24th April 1936.

The authors record the finding in October 1935 of larvae of *Ornithodorus talaje*, Guér., on kangaroo rats (*Dipodomys* sp.) in Arizona and of nymphs and adults of the same species of tick in soil from their burrows, although no ticks were taken on other rodents in the same localities.

Segal (B.). **Synopsis of the Tabanidae of New York, their Biology and Taxonomy. I. The Genus *Chrysops* Meigen.**—*J. N. Y. ent. Soc.* **44** nos. 1–2 pp. 51–78, 125–154, 3 pp. refs. New York, March–June 1936.

This account of the Tabanids of the genus *Chrysops* in New York State is based on the literature and personal observations, and deals in general with their economic importance, bionomics and control, methods for breeding them in the laboratory and for collecting their larvae, and the morphology of all stages. Keys are given for distinguishing eggs, larvae, pupae and adults of *Chrysops* from those of other Tabanid genera occurring commonly in New York State, and for determining the species in the adult stage. Many of these are described, with notes on their distribution and synonymy.

Beier (M.). **Mallophaga. Federlinge oder Pelzfresser.**—*Biol. Tiere Dtschl.* Teil 28, 32 pp., 22 figs., 33 refs. **Siphonaptera. Flöhe.**—*Op. cit.* Teil 39, 36 pp., 23 figs., 29 refs. Berlin, Borntraeger, 1936. Subscription price *M.*9 ; single copies *M.*11·25.

In these further sections of this work [*R.A.E.*, B **20** 36], a general account is given of the morphology and biology of the Mallophaga and fleas.

Vaz (Z). **Ectoparasitas de animaes domesticos observados no Estado de S. Paulo.**—*Arch. Inst. biol.* **6** pp. 29–33, 15 refs. S. Paulo, 1935. [Recd. June 1936.]

This is a check-list (showing synonymy and arranged by hosts) of ectoparasites other than fleas and ticks that attack domestic animals and poultry in the state of São Paulo.

Vaz (Z.). **Sarna do porco do matto por *Sarcoptes scabiei suis*, parasita do porco domestico.** [Mange on a wild Pig due to *S. scabiei suis*, a Parasite of the domestic Pig.]—*Arch. Inst. biol.* **6** pp. 69–70. S. Paulo, 1935. [Recd. June 1936.]

A case of mange is recorded in Brazil due to *Sarcoptes suis*, Gerl., on a wild pig (*Tajassus tajassus*), subsequent to its confinement in a place where infected domestic pigs had been kept.

Bacigalupo (J.). **El *Anisolabis annulipes* (Lucas) en la transmisión de la *Hymenolepis diminuta* y la *Hymenolepis fraterna*.**—*Rev. chil. Hist. nat.* **39** (1935) pp. 127–129, 1 fig., 4 refs. Santiago, Chile, 1936.

After referring to previous records of insect hosts of the Cestode, *Hymenolepis diminuta*, and the Nematode, *Gongylonema neoplasticum*, in Argentina [*R.A.E.*, B **18** 46 ; **19** 21 ; **21** 196], the author gives an account of attempts to infect the earwig, *Anisolabis annulipes*, Lucas, with *H. diminuta* and *H. fraterna*. Some individuals given food containing the eggs of *H. diminuta* and of *G. neoplasticum* were later found to contain larvae of the latter, but no trace of *H. diminuta*. Of others given food containing eggs of *H. diminuta* and *H. fraterna*, one was found to harbour a cysticercoid of *H. diminuta*.

Dallas (E. D.). **Dermatosis causadas por coleópteros del género** *Paederus* (**Staphylinidae**).—*Rev. chil. Hist. nat.* **39** (1935) pp. 219–224, 2 figs., 28 refs. Santiago, Chile, 1936.

This brief survey of information on dermatitis caused by beetles of the genus *Paederus* contains a list of the 19 species recorded in this connection in various parts of the world, including Argentina.

Nieschulz (O.). **Ueber die Blutaufnahme unbefruchteter Tabaniden-weibchen.** [On Blood Ingestion by unfertilised Female Tabanids.] *Zool. Anz.* **112** no. 11–12 pp. 303–305, 3 refs. Leipzig, 15th December 1935.

In experiments with bred individuals of *Tabanus rubidus*, Wied., unfertilised females were found to suck the blood of horses several times, and in 3 cases non-viable eggs were deposited.

Schulze (P.). **Zwei neue Arten der Gattung** *Hyalomma* **und die morphologische Bedeutung der Analbeschilderung der Ixodiden.** [Two new Species of *Hyalomma* and the morphological Significance of the Anal Shield in Ixodids.]—*Zool. Anz.* **114** no. 7–8 pp. 187–192, 17 figs., 8 refs. Leipzig, 15th May 1936.

Descriptions are given by the author and Gossel of *Hyalomma delpyi* sp. n., from cattle, camels and sheep in Persia, *H. steineri*, sp. n., from cattle in Anatolia, and *H. steineri* subsp. *codinai*, n. (of which the host is not stated) from Spain.

Galliard (H.). **Recherches sur les réduvidés hématophages** *Rhodnius* **et** *Triatoma*.—*Ann. Parasit. hum. comp.* **13** nos. 4–6 pp. 289–306, 401–423, 497–527; **14** nos. 1–3 pp. 1–34, 97–112, 193–205, 57 figs., many refs. Paris, 1935–36.

From observations and experiments on various species of the genus *Triatoma* (*sens. lat.*) and on *Rhodnius prolixus*, Stål., the author gives detailed descriptions of the external genitalia of the nymph, the internal and external genitalia of the adults of both sexes, the structure of the eggs, the processes of fertilisation and oviposition, the development of eggs at a constant temperature, hatching and alar coaptations.

Delpy (L.). **Notes sur les ixodidés du genre** *Hyalomma* (**Koch.**).—*Ann. Parasit. hum. comp.* **14** no. 3 pp. 206–245, 2 pls., 20 figs., 47 refs. Paris, 1st May 1936.

The author gives his reasons for agreeing with Schulze [*R.A.E.*, B **19** 96] that the name *Hyalomma aegyptium*, L. (1758), should be applied to the tick infesting the land tortoise later described by Koch (1844) as *H. syriacum*. The male *Hyalomma* drawn by Savigny and described by Audouin under the name *H. aegyptium* is not this species, and the author accepts Schulze's view that the name *H. savignyi*, given to it by Gervais (1844) should be retained and applied to a species of *Hyalomma* infesting mammals in Egypt. Thus the ticks described by other authors under the name *H. aegyptium* or as varieties of it should be incorporated under the name *H. savignyi* or given new names. The author describes the divisions into which the genus *Hyalomma* (*sens.

lat.) was divided by Schulze [**9** 44 ; **19** 96] and reproduces the keys to the males and females of the subgenera of the genus *Hyalomma* (*sens. stric.*).

In the course of four years the author has collected several thousands of ticks of this genus from domestic animals in different parts of Persia. He defines in detail the terms used in the description of ticks, and describes the adults of both sexes of *Hyalomma dromedarii*, Koch, the most prevalent tick of the region. The description was based on a large number of specimens reared in the laboratory, as well as on others collected in the field, so that the author was able to distinguish characters of specific value from individual variations. He therefore reviews from the original texts the descriptions of many species and subspecies of the group of *dromedarii*, and concludes that *H. asiaticum*, P. Sch. & Schl., *H. dromedarii canariense*, P. Sch. & Schl., *H. yakimovi*, Olen., and *H. yakimovi persiacum*, Olen., should be treated as synonyms of *H. dromedarii*.

STEWARD (J. S.). **Fistulous Withers and Poll-evil. Equine and Bovine Onchocerciasis compared, with an account of the Life-histories of Parasites concerned.**—*Vet. Rec.* (N.S.) **15** no. 52 pp. 1563–1573, 4 pls., 32 refs. London, 28th December 1935. [Recd. June 1936.]

The author discusses the diseased conditions of horses known as fistulous withers and poll-evil and suggests for them the name nuchal disease, posterior or anterior, according to the site involved. He reviews the literature and describes briefly a large number of cases. He concludes that they may be classified as infections with *Onchocerca cervicalis* alone, with *O. cervicalis* and *Brucella abortus*, with *O. cervicalis* and secondary pyogenic infections (streptococci, staphylococci or both), with pyogenic organisms alone (probably superficial or non-typical cases, possibly of traumatic origin) and possibly with *B. abortus* alone or complicated with secondary pyogenic infection.

The clinical symptoms, microscopic anatomy and treatment of these different types are outlined. Information is also given on the life-history of *O. cervicalis* and on the evidence that it is transmitted by *Culicoides nubeculosus*, Mg., and other species of the genus [*R.A.E.*, B **22** 59]. *C. nubeculosus* breeds chiefly in liquid farm manure and collections of stagnant water containing green slime and decaying organic matter ; running water does not seem to be suitable. It is suggested that the vector might be controlled by drying up the breeding places or treating them with larvicides. A breeding place of *C. nubeculosus* was destroyed by the addition of liquid waste products from the manufacture of cheese ; fermentation took place, and the acid reaction produced in the liquid manure caused the death of the larvae. As the midges do not fly far, it is also suggested that horses infected with *O. cervicalis* should be removed during the fly season (April to October) from the vicinity of breeding places.

Onchocerca gutturosa has recently been found in cattle for the first time in England. It occurs in the ligamentum nuchae but causes no serious injury, probably because its habitat is in the connective tissue between the lamellar portions, whereas *O. cervicalis* occurs in the substance of the ligament and destroys the fibres, etc. The development of *O. gutturosa* takes place in a species of *Simulium* and is very similar to that of *O. cervicalis* in *C. nubeculosus*. The latter does not appear

to be capable of picking up the microfilariae of *O. gutturosa*, although they occur in the same situation in cattle as those of *O. cervicalis* in the horse.

CORY (E. N.), HARNS (H. G.) & ANDERSON (W. H.). **Dusts for Control of Flies on Cattle.**—*J. econ. Ent.* **29** no. 2 pp. 331–335. Menasha, Wis., April 1936.

During 1933 and 1934 experiments were carried out in Maryland on cows in the field to test the efficacy of a fly spray and of various pyrethrum and derris dusts in protecting them from flies [including *Stomoxys calcitrans*, L., *Musca domestica*, L., *Lyperosia irritans*, L., and Tabanids]. A laboratory study was also undertaken to determine the action of these two insecticides on *Stomoxys* and *Musca*.

The following is taken from the authors' summary of the laboratory tests : Pyrethrum and derris dusts have little or no repellent action against the house fly and stable fly under conditions of forceful tropism, protection being secured through the toxic action of the materials. The stable fly is more susceptible to these dusts than the house fly. The addition of pine oil prolongs the time required for the fly to acquire a toxic dose of the material. There is evidence that pine oil increases the toxic action of the derris dusts, which have a relatively low initial toxic rating.

The following are the author's conclusions : Results of dusting or spraying experiments should be calculated on the basis of the average performance of a standard material in order that the effect of climatological variables may be evaluated. Impregnated dusts are generally superior to mixed dusts in the same series. Stabilisation does not significantly increase the value of the dusts. Pyrethrum-impregnated dusts provide more protection per unit cost than do the derris-impregnated dusts, but the derris-impregnated dusts are more toxic per unit than are the pyrethrum-impregnated dusts. Impregnated dusts give better protection than the spray. Pine oils add little to the efficiency of the impregnated dusts. They increase the initial toxicity rating of the materials but lower their efficiency over a period of 3½ hours.

ELMORE (J. C.) & RICHARDSON (C. H.). **Toxic Action of Formaldehyde on the Adult House Fly** *Musca domestica* **L.**—*J. econ. Ent.* **29** no. 2 pp. 426–433, 1 graph, 13 refs. Menasha, Wis., April 1936.

The authors' summary and conclusions are as follows : The effect of formaldehyde on the adult house fly, *Musca domestica*, L., was determined by feeding individual flies small drops of solutions which contained known concentrations of formaldehyde [HCHO] or paraformaldehyde [$(CH_2O)_nH_2O$]. The amount of toxic liquid imbibed was ascertained immediately after feeding from the gain in weight of the fly. The population from which the test insects were taken comprised flies from 7 to 24 milligrams with a mean weight of $15{\cdot}6 \pm {\cdot}1$ milligrams.

Formaldehyde causes progressive paralysis of the nervous system from posterior to anterior. The median lethal dose of paraformaldehyde calculated as HCHO is estimated as 2·24 mg. per gm. of body weight ; for commercial formaldehyde it is estimated as 1·54 mg. HCHO/gm. The greater toxicity of unneutralised commercial formaldehyde solutions as compared with paraformaldehyde solutions

probably results from the greater concentration of unpolymerised formaldehyde in the former. The greater repellence of the commercial formaldehyde solutions may also contribute to their lower median lethal dose.

Formic acid solution (pH 2·4) was less repellent to house flies than a 3 per cent. solution of unneutralised commercial formaldehyde of pH 3·5. Para-formaldehyde solution (3 per cent. HCHO) adjusted to pH 3·5 with formic acid was also less repellent than unneutralised commercial formaldehyde solution. A solution of commercial formaldehyde, neutralised with potassium hydroxide, was similar in repellent properties to paraformaldehyde solution of equivalent HCHO concentration. The addition of alkali to commercial formaldehyde solution causes rapid polymerization as well as acid neutralisation. The greater repellence of unneutralised commercial formaldehyde solution is probably the result of the greater concentration of unpolymerised HCHO in such solutions.

Papers noticed by Title only.

DAVIS (J. J.). **The Mosquito Problem in Indiana** [popular account].—*Ext. Bull. Purdue Univ. Dep. Agric.* no. 207, 8 pp., 2 figs. Lafayette, Ind., April 1935. [Recd. June 1936.]

WU (SHIH-CHENG). **The Eggs of some Chinese Anopheline Mosquitoes** [Key and descriptions of 20 species]. [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 13 pp. 261–273, 20 figs., 14 refs. Hangchow, 1st May 1936. (With a Summary in English.)

PETERS (G.). **Chemie und Toxikologie der Schädlingsbekämpfung.** [The Chemistry and Toxicology of Pest Control.]—*Samml. chem.-tech. Vortr.* N.F. Heft 31, 120 pp., 22 figs. Stuttgart, F. Enke, 1936. Price, paper, *M.* 6·90; in Germany, Switzerland & Palestine *M.* 9·20. [See *R.A.E.*, A **24** 487.]

BRUMPT (E.). **Etude historique concernant l'étiologie de la fièvre récurrente sporadique de l'Asie** [in Persia and Central Asia.]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 41–53, 3 pp. refs. Moscow, 1935. (With a Summary in Russian.)

PARROT (L.). **Les éléments de diagnose spécifique des diptères du genre** *Phlebotomus* **(Psychodidae).**—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 198–201, 8 refs. Moscow, 1935. (With a Summary in Russian.) [See *R.A.E.*, B **23** 43.]

FREUND (L.). **Die Europäische Hirsch- und Rehlaus.** [The Lice of the European Reindeer and Roedeer; descriptions of *Solenopotes burmeisteri*, Fahrenholz, on *Cervus elaphus*, and *S. capreoli*, sp. n., on *C. capreolus*.]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. Sci. Pavlovsky* 1909–34, pp. 275–280, 12 figs., 2 refs. Moscow, 1935. (With a Summary in Russian.)

[PAVLOVSKIĬ (E. N.), STEĬN (A. K.) & OLSUF'EV (N. G.).] **Павловский (Е. Н.), Штейн (А. К.) и Олсуфьев (Н. Г.). Experiments on the Action of the Saliva of Gadflies** [Tabanids] **on the Skin.** [*In Russian.*]—In *Parasites, transmetteurs, anim. venimeux. Rec. Trav. 25e Anniv. sci. Pavlovsky* 1909–34 pp. 426–447, 12 figs., 2 pls., 22 refs. Moscow, 1935. (With a Summary in English.)

MAZZA (S.) & ROMAÑA (C.). **Comprobación de** *Panstrongylus* (*Triatoma*) *geniculatus*, **vinchuca de los tatú, en el Chaco santafecino.** [Record in the Chaco District of the Province of Santa Fé, Argentina, of *P. geniculatus*, Latr., the Reduviid of Armadillos.]—8. *Reun. Soc. argent. Pat. reg. Norte, Santiago del Estero* 1933, ii pp. 467–468, 8 refs. Buenos Aires, 1936. [See *R.A.E.*, B **20** 102.]

MAZZA (S.) & SEÑORANS (A. J.). **Miasis forunculosa por** *Dermatobia hominis* **en el Chaco.** [Furuncular Myiasis in Man due to *Dermatobia hominis*, Say, in the Chaco Territory, Argentina.]—8. *Reun. Soc. argent. Pat. reg. Norte, Santiago del Estero* 1933, ii pp. 479–481, 2 figs., 6 refs. Buenos Aires, 1936. [*Cf. R.A.E.*., B **21** 48.]

BRUMPT (E.). **Hôtes Vecteurs vicariants** [ticks] **du virus de la fièvre pourprée des montagnes Rocheuses.**—8. *Reun. Soc. argent.Pat. reg. Norte, Santiago del Estero* 1933, ii pp. 496–502. Buenos Aires, 1936. [*Cf. R.A.E.*, B **22** 2, etc.]

BRUMPT (E.). **Fièvre récurrente sporadique des Etats-Unis due à** *Spirochaeta truicatae* **n. sp. et transmise dans la nature par** *Ornithodorus turicata* [Dugès].—8. *Reun. Soc. argent. Pat. reg. Norte, Santiago del Estero* 1933, ii pp. 566–571. Buenos Aires, 1936. [See *R.A.E.*, B **21** 243.]

RONDELLI (M. T.). **Ixodoidea del Fezzan e della Somalia italiana raccolti dal Prof. E. Zavattari e dal Prof. C. Tedeschi.** [Ixodoidea of the Fezzan Region and of Italian Somaliland collected by Prof. E. Zavattari and Prof. C. Tedeschi.]—*Atti Soc. ital. Sci. nat.* **74** pp. 239–252, 6 figs. Milan, 1935. [Recd. May 1936.]

SCHULZE (P.). **Zur Kenntnis der Zeckengattung** *Aponomma* **Neum.** [Contribution to a Knowledge of the Tick Genus *Aponomma* (including 2 new species).]—*Zool. Anz.* **112** no. 11–12 pp. 327–331, 5 figs., 9 refs. Leipzig, 15th December 1935.

KIRSCHENBLATT (J.). **Beiträge zur paläarktischen Zeckenfauna.** [Contributions to the Palaearctic Tick Fauna (including a list of species of *Ixodes* in Transcaucasia).]—*Zool. Anz.* **114** no. 3–4 pp. 93–97, 5 figs., 8 refs. Leipzig, 15th April 1936.

WAGNER (J.). **Einige neue oder wenig bekannte Floharten.** [Some new or little known Species of Fleas (including 4 new species and 3 new subspecies).]—*Z. Parasitenk.* **8** no. 3 pp. 332–350, 22 figs., 3 refs. Berlin, 4th March 1936.

PHILIP (C. B.). **New Tabanidae (Horseflies)** [from U.S.A.] **with Notes on certain species of the** *longus* **Group of** *Tabanus.*—*Ohio J. Sci.* **36** no. 3 pp. 149–156, 5 refs. Columbus, Ohio, May 1936.

THOMPSON (G. B.). **The Parasites of British Birds and Mammals. IX. A Bibliography of the Papers containing Records of Mallophaga (Biting-lice) from Birds and Mammals.**—*Ent. mon. Mag.* **72** no. 866 pp. 159–161. London, July 1936.

KRUPSKI (A.) & OSTERWALDER (H.). **Ein Fall einer Dassellarvenmeningitis spinalis beim Rind** [a case of Spinal Meningitis in a Cow caused by a Larva of *Hypoderma*].—*Schweiz. Arch. Tierheilk.* **78** Heft 1 pp. 18–20, 1 fig., 3 refs. Zürich, January 1936. [French translation in *Ann. Méd. vét.* **81** no. 4 pp. 183–185. Brussels, April 1936.]

Jack (R. W.). **Annual Report of the Division of Entomology for the Year ended 31st December, 1935.**—*Rhod. agric. J.* **33** no. 5 pp. 329–356; also as *Bull. Minist. Agric.* [*S. Rhodesia*] no. 986, 28 pp. Salisbury, May 1936.

In the medical and veterinary section of this report (pp. 335–346) details are given of the situation in 1935 in localities in Southern Rhodesia, where work against *Glossina morsitans*, Westw., is in progress [*cf. R.A.E.*, B **23** 294]. The general advance of the fly has been arrested along the whole front with the possible exception of a short section in the west between the Shangani and the Zambesi Rivers, where operations have not been considered practicable on account of the nature of the country [*cf.* **21** 222]. It is estimated that over 2,000 square miles have been practically cleared of fly. Trypanosomiasis due to *G. morsitans* has been almost eradicated from European farming areas except in the Gwaai settlement, where fly has been present since the establishment of the settlement as an anti-tsetse measure in 1929. Details are given of the numbers of flies taken at the various traffic control stations from cars, cyclists and pedestrians. In most cases the numbers in 1935 were considerably lower than in the previous three years. At the Gatooma station the decrease was associated with a similar decrease in density of fly in the zone west of the fenced area, where operations were begun in 1932, and the great reduction in the Gwaai-Shangani area with the successful progress of operations in that region. During 1935 only conservation work, including the broadening of the clearing in certain sections, was carried out in the Melsetter district [*cf.* **23** 294], where the flies concerned are *G. pallidipes*, Aust., and possibly *G. brevipalpis*, Newst. The clearing was successfully burnt in September and October. The position with regard to trypanosomiasis has remained much more satisfactory than before the clearing was made, but some cases occurred on several farms during the first part of the year. The initiation of laboratory research work at Salisbury on the physiology and behaviour of tsetse flies is discussed.

The infestation by *Chrysomyia bezziana*, Villen., of sores caused by cattle rubbing the places where they have been attacked by *Lyperosia minuta*, Bezzi, was reported from one district. *Amblyomma hebraeum*, Koch, the vector of heartwater, has spread to widely separated localities in Matabeleland, and the usual dipping measures have had to be supplemented by hand dressing. Many Pentatomid bugs (*Agonoscelis erosa*, Westw.) were removed from the rumen and abomasum of apparently poisoned cattle in one district. It is possible that the copious excretions from these insects were toxic to the animals. The bugs cluster on shrubs and herbage, and the cattle probably swallow them in the course of feeding.

Following criticisms of the efficacy of the operations against *G. morsitans* in Southern Rhodesia, the Executive Committee of the Trypanosomiasis Committee examined evidence submitted to it by interested persons throughout the Colony and in England, and their conclusions are appended to the report. In the opinion of the Committee the present system of organised and carefully controlled slaughter of game, as and when necessary, together with adequate fencing and the necessary control of traffic, should be continued until an effective alternative is forthcoming, but to hasten the discovery of

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alternative methods it urges the Government to make adequate provision for research into the bionomics of the fly and the diseases transmitted by it.

Handa (B. N.). **A Review of the Warble Fly Pest in India and Measures for its Control, with particular Reference to the Government Cattle Farm, Hissar.**—*Agric. Live-Stk India.* **6** pt. 2 pp. 195–201, 4 refs. Delhi, March 1936.

The author discusses from the literature the losses caused in India by the infestation of domestic animals, particularly cattle, by warble flies, their life-history, the symptoms produced by their attack and methods for their control [*cf. R.A.E.*, **19** 112; **22** 152]. He states that the two warble flies in India are *Hypoderma bovis*, DeG., which occurs in Bengal, Bihar and Orissa, the Central Provinces, etc., and *H. lineatum*, Vill., which is found in the Punjab, North-West Frontier Province, Sind and Baluchistan. A tobacco powder and lime wash similar to one advocated by the Warble Fly Committee in England [*cf.* **15** 9] is used at the Government Cattle Farm, Hissar, from October to January. It is applied over the back and sides of the cattle with a stiff brush, three or four dressings at intervals of three weeks being required.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). A Course in Parasitology of Man.** [*In Russian.*]—Demy 8vo, 592 pp., 445 figs., 1 fldg. pl., 22 refs. Leningrad, Gos. Izd. biol. med. Lit. [St. Pub. biol. med. Lit.], 1934. Price 8 *rub.*: binding 1 *rub.* 20 *kop.* [Recd. May 1936.]

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.). A practical Text-book of medical Parasitology.** [*In Russian.*]—Demy 8vo, 434 pp., 230 figs., many refs. Leningrad, Gos. Izd. biol. med. Lit. [St. Pub. biol. med. Lit.], 1935. Price 6 *rub.* 85 *kop.* [Recd. May 1936.]

The first of these handbooks is a considerably amplified edition of a work already noticed [*R.A.E.*, A **12** 171], which has been rewritten. It is intended for the use of physicians and medical students and opens with general information on parasitism, particularly of man, the various forms and types of parasites, and the aims and scope of parasitology as an independent science. The rest of the book is divided into three parts, of which the first two deal with Protozoa and Helminths, and the third (pp. 324–568) with Arthropods, especially those that are vectors of disease. In each part notes are given on the morphology, anatomy, bionomics and pathogenic importance of the individual parasites, which are dealt with in systematic order, as well as on therapeutic and prophylactic measures. Attention is chiefly devoted to parasites and vectors of diseases that occur in the Russian Union and the adjoining countries.

The second handbook, to which nine authors have contributed, is a supplement to the first one and is designed to serve medical students as a practical guide to laboratory investigations. In the introductory section, notes are given on the collection of ectoparasites from animals, and on dissection technique and the making of simple microscopical preparations. The main part of the book is divided into three sections

(Arthropods, Helminths and Protozoa), and the section devoted to Arthropods contains separate chapters on ticks and the principal groups of insects of medical importance, notes being given on their collection and dissection, the morphology of the various stages, and the preparation and preservation of material. A bibliography is appended to each chapter. A separate chapter contains information on the different malaria parasites and the preparation of blood smears, and in a supplement the preparation of *Leishmania* bodies and of the poisonous organs of various animals is discussed.

STRICKLAND (C.). **Hill Malaria.**—*Indian med. Gaz.* **70** no. 10 pp. 559–560, 3 refs. Calcutta, 1935.

STRICKLAND (C.) & CHAUDHURI (H. P.). **More on Hill Malaria.**—*Op. cit.* **71** no. 5 pp. 267–269, 1 ref. Calcutta, May 1936.

In the first paper an account is given of the distribution of malaria infection in Bengal, from Calcutta to the Himalayas, with regard to season and altitude. In the low plains during the hot season physical conditions prevent the infection of Anophelines [*cf. R.A.E.*, B **21** 78] and all cases of malaria are relapses or manifestations of an earlier infection, probably due to heat, but from then onwards the infection rate in the vectors increases until in November-January it reaches about 100 per cent. On the other hand, in the high hills there is no infection of the mosquito at any season, and the few cases of malaria are relapses, probably due to cold. In the intervening area during the hot spring months the rate of infection in the mosquito increases up to a point (about 1,600 ft.) where the physical conditions (of which a moderate temperature is the most important) are at an optimum; at the same time the number of relapse cases decreases and the number of new infections increases. Above this point the mosquito infection rate decreases. In the low plains the greatest infection rate is found in November–January (the greatest numbers of new infections in man occur in September and October), and at this season there is a gradual decline in the infection rate from this region up to the high hills, owing to the increasing cold which inhibits infection. Thus in the hot spring months travellers should stay low in the valleys until they can move directly up to a point as high as possible above the 1,600 ft. contour line. In the autumn, at the end of the rains, they should keep as high as possible all the time.

In the second paper the author describes experiments undertaken to determine whether the spring epidemic of malaria in the low hills is spontaneous, or whether it is the result of infection acquired by man in the previous autumn that remains latent until April–May. In October–December 1935, mosquitos that had fed on infected persons in Calcutta were transported to the hills. Only 3 out of 49 dissected and examined after 10 days had glands infected with sporozoites and these were all included in two batches that had been kept for most of the time in a closed room on the south side of the laboratory that was warmed by the sun or by a charcoal fire, whereas the other batches were kept in a room open day and night. The rate of sporozoite infection in control batches kept in Calcutta was 58·5 per cent., as compared with this rate of about 6 per cent., and it seems probable from the above results that under natural conditions mosquitos do not become infected in the autumn in the hills. On the other hand the

mosquito continues to develop throughout the cold weather; larvae pupated when kept in the open at 3,000 ft. and larvae and pupae were found up to 5,000 ft. Moreover, the adults bite at this season. Thus the reason that there is practically no autumnal malaria in the hills at an altitude of 2,500–4,000 ft. appears to be that the physical conditions inhibit infection in the mosquito, and mosquito nets may therefore be discarded with impunity.

MANSON (D.). **Velocity, Silt and Larval Drift.**—*Indian med. Gaz.* **71** no. 5 pp. 270–275, 3 charts, 6 refs. Calcutta, May 1936.

Previous research by the author in the laboratory showed that the death rate of Anopheline larvae in flowing water is closely correlated with its velocity and that silt is of little importance. To corroborate these findings, observations were made once a week from April 1934 to December 1935 on three widely separated rivers in Assam. The velocity of the water, its silt content and the presence or absence of larvae of *Anopheles minimus*, Theo., the principal vector of malaria, were recorded; the results are shown in tables and charts, which in two cases out of three also include rainfall. It had previously been stated that permanent streams and rivers were generally free from larvae of this species during the monsoon period, except in years when there was a shortage of rainfall, but the present observations showed that the larvae were present on many occasions after the onset of the monsoon in mid-June, in years of normal rainfall; they were found in one instance between 8th June and 21st September, and in another from 15th August onwards, according to the rate of flow of the water and the distribution of the rainfall. Moreover, as they were present in the straight stretches examined, they were probably more common in tortuous and ragged channels. Thus larval drift in permanent rivers must be taken into account in any scheme of anti-larval control. For this reason the author criticises the scheme put forward by Rice [*R.A.E.* B **24** 79] in which he suggests that antilarval measures should only be carried out from early January to mid-June, because it does not take into account the enormous numbers of larvae that occur near the banks of all permanent rivers for miles outside the relatively small zones of control. These larvae, carried in by drift, would give rise to adults that would seek safer areas for oviposition in the usual summer breeding places. Adult migration and propagation would proceed at this time without check, and the result would be intensive Anopheline breeding and prevalent malaria. Moreover larvae of *A. minimus* are abundant from mid-June to November in streams and reservoirs and in many secondary breeding places in receptacles temporarily filled by rain, the highest sporozoite rate being found in this district in October. No pre-monsoon control measures would prevent the invasion.

There again appeared to be no relation between the presence of silt and the presence or absence of larvae. Silt is closely related to variations in water velocity. Possibly it may act by causing scouring of the marginal vegetation, which affords anchorage for larvae. Velocities that exceed an average of 2·04 miles per hour (maximum 2·25 and minimum 1·375) are inimical to Anopheline larvae in Assam. Local rainfall shows some degree of correlation, but not such a close one, as rain in the hills influences velocity and silt independently of local rainfall. The possibility of controlling larval drift is discussed.

Komp (W. H. W.). **An annotated List of the Mosquitoes found in the Vicinity of an endemic Focus of Yellow Fever in the Republic of Colombia.**—*Proc. ent. Soc. Wash.* **38** no. 4 pp. 57–70, 17 refs. Washington, D. C., May 1936. **The Male and Larva of** ***Aëdes dominicii*** **Rangel & Romero Sierra, and the Male of** ***Aëdes pseudodominicii*** **sp. nov., Representatives of a new Subgenus (*****Soperia*****) of the Genus** ***Aëdes*** **from Colombia.**—*T.c.* pp. 71–75, 2 figs., 3 refs.

In the first paper notes are given on the breeding places, prevalence, biting habits, etc., of 78 of the species of mosquitos collected between 8th July and 23rd September in the vicinity of Restrepo, Colombia, where cases of yellow fever had occurred [*cf. R.A.E.*, B **24** 35]. No examples of *Aëdes aegypti*, L., were taken. The author states that the species referred to by Soper [*loc. cit.*] as *Haemagogus equinus*, Theo., was misidentified and is in reality *H. janthinomys*, Dyar. He considers that *Psorophora ferox*, Humb., is potentially far more dangerous than the species of *Haemagogus*; it was present throughout the period of the survey, is an aggressive biter and has been shown capable of transmitting yellow fever [**20** 10].

In the second paper he gives notes on the adults and describes the male terminalia and larva of a species of *Aëdes* provisionally referred to *Aëdes dominici*, R. & R. S., and the male of *A. pseudodominici*, sp. n. He erects the new subgenus *Soperia* for these two species, both of which were taken near Restrepo.

Gil Collado (J.). **Culícidos de la Isla de Fernando Poo recogidos por la expedición J. Gil.-F. Bonet.**—*Eos* **11** no. 4 pp. 311–329, 8 figs. Madrid, June 1936.

Records are given of 30 species of mosquitos collected in the island of Fernando Po in January–March 1933, during the dry season, together with descriptions of two new species of *Aëdes* and of *Anopheles* (*Myzomyia*) *lloreti*, sp. n., which was bred from larvae taken in the shady back-waters of two mountain streams. There was no vegetation in the breeding places. The other Anophelines collected were *A. gambiae*, Giles, *A. funestus*, Giles, *A. smithi*, Theo., and *A. cinctus*, Newst. & Cart.

Bailey (S. F.). **Thrips attacking Man.**—*Canad. Ent.* **68** no. 5 pp. 95–98, 11 refs. Orillia, May 1936.

The author gives an account from the literature and from his own observations of cases in which various species of thrips in different parts of the world have caused irritation by attacking man. From experiments in which he confined certain species on his arm, he concludes that both phytophagous and predacious ones fed only intermittently in some cases. He considers that these insects must be placed among the possible vectors of diseases of man as well as of plants [*cf. R.A.E.*, A **24** 156].

Baerg (W. J.). **The Black Widow.**—*Bull. Ark. agric. Exp. Sta.* no. 325, 34 pp., 9 figs, 45 refs. Fayetteville, Ark., February 1936. [Recd. June 1936.]

An account is given of the morphology, distribution, bionomics, natural enemies and control of *Latrodectus mactans*, F. [*cf. R.A.E.*, B

23 212, etc.], which is sporadically abundant in Arkansas. The fangs and poison glands and the effect of the bite on man and laboratory animals are described, and suggestions for treatment are made.

KEMPER (H.). **Die Bettwanze und ihre Bekämpfung.** [The Bed-bug and its Control.]—*Hygienische Zoologie*, Band 4, 107 pp., 2 figs., 8 pls., 11 pp. refs. Berlin, 1936. Price *M.* 4·80. (Also as *Kleintier und Pelztier* **12** no. 3. Leipzig, Deutsche Ges. f. Kleintier- und Pelztierzucht, May 1936.)

This monograph has been prepared from the literature on *Cimex lectularius*, L., in order to provide a complete statement for those engaged on measures for its control and a survey of the results of investigations already made. Chapters deal with its history, distribution, classification, morphology, biology and hygienic importance, and with measures for preventing and eradicating infestations.

KOFOID (C. A.) & WHITAKER (B. G.). **Natural Infection of American Human Trypanosomiasis in two Species of Cone-nosed Bugs,** *Triatoma protracta* **Uhler and** *Triatoma uhleri* **Neiva, in the western United States.**—*J. Parasit.* **22** no. 3 pp. 259–263, 3 refs. Baltimore, Md, June 1936.

Large numbers of *Trypanosoma cruzi* in the metacyclic infective stage were observed in the faeces of 7 out of 79 examples of *Eutriatoma* (*Triatoma*) *uhleri*, Neiva, collected in the vicinity of Tucson, Arizona, between November 1934 and June 1935, and in the same locality were found 2 uninfected examples of *T. protracta*, Uhler, which has previously been proved to be a vector of this trypanosome in California [*cf. R.A.E.*, B **23** 40; etc.]. All 4 specimens of a batch of *E. uhleri* taken from the nest of a wood rat (*Neotoma fuscipes*) and from the pile of lumber in which the nest had been constructed were infected. One large nymph caught in a bed was infected and engorged, but the nature of the blood could not be determined. Numbers of the bugs (of which 2 were infected) were collected in various rooms in a house, usually after 7 p.m. and particularly on the sleeping porch between midnight and 3 a.m. Members of the household were bitten by them, but only while sleeping. The bites were followed by both local and general reactions, presumably caused by the salivary secretions of the bugs, as there was no evidence that they were associated with trypanosome infection. The bugs migrate actively, gain access to the bed after it is occupied, engorge, and return to a suitable hiding place. The infection produced in a white-footed mouse (*Peromyscus californicus insignis*) inoculated with the faeces of 2 of the bugs from Arizona more closely resembled the heavy infection produced by the South American strain of *T. cruzi* than that produced by the relatively non-virulent strain from California. The possibility of human infection in California was believed to be small since the wood rats and other natural mammalian reservoirs usually live in uninhabited regions, the rate of infection in rats and bugs is not high, the strain of *T. cruzi* is not virulent, the parasites appear in the peripheral blood of the animal in small numbers for a short time, and the mode of human infection, which consists in rubbing infected faeces

of the bug into lesions in the skin caused by the bite, is not easy. On the other hand, where there is a tendency for wood rats to enter and build nests in and about houses, and for the insect vector, which is attracted by warmth, to enter houses and beds and feed on man, the possibility of human infection is greatly increased.

HERMS (W. B.) & WHEELER (C. M.). *Ornithodoros hermsi* **Wheeler as a Vector of Relapsing Fever in California.**—*J. Parasit.* **22** no. 3 pp. 276–282, 6 refs. Baltimore, Md, June 1936.

Since the first two cases of relapsing fever were reported from California in 1922, 95 cases have been recorded ; 46 have occurred at Big Bear Lake and 26 at Lake Tahoe, both of which are popular summer resorts where there are a number of privately owned summer cottages, and the remaining 23 in widely scattered localities, practically all of them along a line connecting the two main foci at elevations ranging from 5,000 to 8,000 ft. Previous work on the transmission of the disease by *Ornithodorus hermsi*, Wheeler, is reviewed [*cf. R.A.E.*, B **24** 61 ; etc.]. Further laboratory experiments, the technique of which is described, show that the spirochaete can be transmitted by larvae derived from an infected female, though the percentage of infected larvae seems to be low. In some cases, larvae from an apparently non-infective female produced infections, and, conversely, larvae from an infected female did not produce infections, although some of the nymphs derived from them proved positive. When uninfected larvae are allowed to feed on infected mice, about 30 per cent. transmit the disease to healthy mice in some subsequent developmental stage. One mature female has induced four infections at intervals during a period of about four months, and it would appear that once infected these ticks remain so for the rest of their lives.

Collections indicate that the tick occurs in the Sierra Nevada and San Bernardino mountain ranges at elevations of 5,000–8,000 ft. It appears to be typically a parasite of rodents, but feeds freely on a variety of experimental animals as well as on man. Numerous examples of all stages except larvae have been taken in the nests of chipmunks (*Eutamias*) in summer cottages. The characters distinguishing it from allied species are given [*cf.* **23** 284]. In the laboratory at a constant temperature of 75°F. and a degree of humidity of over 90 per cent., females laid more than 200 eggs in batches of 12–140 at intervals from May to October. The incubation period ranged from 15 to 21 days. The percentage of larvae hatching appeared to decrease from as high as 95 in the first batches of eggs laid to less than 50 in the last. The first moult usually takes place within the egg, but the larva remains hexapod until the second moult. After about 2 days the larva is ready to feed but remains attached to the host for only about 12–15 minutes ; the later stages in many cases may remain attached for 30–60 minutes. The second moult takes place about 15 days after the feed. The first instar nymph may feed within a few hours. The first and second nymphal instars last 11–15 and 10–32 days respectively. After the fourth moult the adult may appear, although another feed and moult are usually necessary before maturity is reached. Pairing takes place a few days after the last moult and oviposition may begin in about 30 days. The life-cycle from egg to egg under these laboratory conditions was completed in about 4 months. This cycle may be greatly prolonged, since the tick is able to withstand starvation ; larvae

may live as long as 75 days without food, unfed first moult nymphs can live more than 4½ months, and one adult tick taken in nature has already lived 14 months with only three feeds in the interim.

Herms (W. B.) & Howell (D. E.). **The Western Dog Tick,** *Dermacentor occidentalis* **Neum., a Vector of Bovine Anaplasmosis in California.**—*J. Parasit.* **22** no. 3 pp. 283–288, 9 refs. Baltimore, Md, June 1936.

The experiments described in this paper on the transmission of *Anaplasma marginale* from infected to healthy cattle by means of ticks have already been noticed [*R.A.E.*, B **24** 173], with the exception of one in which it was transmitted by means of nymphs of *Dermacentor occidentalis*, Marx, that had already transmitted the disease as larvae [*cf. loc. cit.*] and were the progeny of ticks infected as adults.

D. occidentalis has been taken on cattle, horses, man, deer, mules, dogs, donkeys, rabbits and sheep, in that order of frequency. It is found at all seasons of the year on these hosts but is most numerous during the rainy season. All stages have been taken on cattle. It is common from central Oregon to Lower California, and is the most abundant Ixodid in California, where it may be found in practically all hilly areas. The preoviposition and incubation periods averaged 21 and 32 days ; unfed larvae lived for a maximum of 93 days ; engorgement took an average of 4 days ; moulting occurred 7–11 days after dropping from the host ; nymphs fed in 6–11 days ; moulting occurred 15–25 days after dropping from the host ; and adults completed their feed in about 7 days. Characters by which *D. occidentalis* may be distinguished from allied species are given. Under laboratory conditions its immature stages were less able to withstand a long period of starvation than those of other ticks. Pasture rotation might therefore be used as a control measure, but would involve the exclusion of other hosts such as rodents, dogs, horses and deer [*cf.* **22** 37]. Sheep and goats, which may be infected with anaplasmosis without clinical symptoms, may be considered as possible reservoirs.

Stage (H. H.) & Yates (W. W.). **Some Observations on the Amount of Blood engorged by Mosquitoes.**—*J. Parasit.* **22** no. 3 pp. 298–300. Baltimore, Md, June 1936.

In localities where mosquitos are exceedingly numerous, the question of the quantity of blood removed from animals attacked by them has frequently been raised. Observations on this point were made in Oregon on a horse on an island where *Aëdes lateralis*, Mg. (*aldrichi*, Dyar & Knab.) and *A. vexans*, Mg., were very abundant, the former being approximately twice as numerous as the latter. It was determined that 500–700 mosquitos fed simultaneously and without much apparent discomfort to the animal. Groups of unfed and fully engorged mosquitos were weighed within a few hours of capture, during which interval there was undoubtedly a loss in weight. The average weights of specimens of *A. vexans* and *A. lateralis* respectively were $1{\cdot}796 \pm 0{\cdot}04$ mg. and $1{\cdot}473 \pm 0{\cdot}043$ mg., when unfed, and $3{\cdot}873 \pm 0{\cdot}11$ mg. and $3{\cdot}58 \pm 0{\cdot}117$ mg., when engorged. From these figures it is computed that the horse lost approximately 24 cc. blood daily. So far as could be ascertained there was no marked loss of weight and no other injurious effect in the animal.

[Popov] Popow (P. P.) & Achundow (I.). **Das Vorkommen des *Ornithodorus lahorensis* Neumann 1908 in Aserbaijdjan und die Frage über die Anwesenheit des Zeckenrückfallfiebers in A.S.S.R.** [The Occurrence of *O. lahorensis* in Azerbaijan and the Question of the Presence of Tick-borne Relapsing Fever there.]—*Arch. Schiffs- u. Tropenhyg.* **40** no. 7 pp. 289–295, 4 figs., 28 refs. Leipzig, July 1936.

In 1935, examples of *Ornithodorus lahorensis*, Neum., were found near Baku in cracks in the stone walls of an old caravanserai, used by night as a shelter for sheep, camels and horses, and numbers were observed in sheep stalls nearby [*cf. R.A.E.*, B **23** 91]. Particulars are given of a case considered to be tick-borne relapsing fever that occurred near Baku, and as Pavlovskiĭ does not regard *O. lahorensis* as a vector [**21** 97], a search is being made for *O. papillipes*, Bir., a known vector in Central Asia [*cf.* also **23** 163].

[Ozerskiĭ (N. N.), Shepelev (K. M.) & Zasukhin (D. N.).] **Озерский (Н. Н.), Шепелев (К. М.) и Засухин (Д. Н.). Materials for the Study of the Nuttaliasis of Horses.** [*In Russian.*]—*Trud. saratov. nauch.-issledov. vet. Inst.* **3** pp. 125–147, 8 graphs, 3 figs., 2 refs. Saratov, 1936.

This paper, which deals with the clinical aspects of equine piroplasmosis caused by *Nuttallia minor* and *N. equi*, as observed in June–October 1934 in the Department of Saratov, contains brief notes on the part played by ticks in the transmission of the disease [*R.A.E.*, B **23** 280].

[Zasukhin (D. N.), Lonzinger (G. K.) & Okrokvertzkhova (L. A.).] **Засухин (Д. Н.), Лонзингер (Г. К.) и Окрокверцхова (Л. А.). Materials for the Study of the Ticks *Ixodes ricinus* L. in the south-east of the R.S.F.S.R.** [*In Russian.*]—*Trud. saratov. nauch.-issledov. vet. Inst.* **3** pp. 148–154, 1 map, 1 ref. Saratov, 1936.

In European Russia, piroplasmosis of cattle caused by *Piroplasma* (*Babesiella*) *bovis* has been recorded from the north-west and west, the Departments of Moscow and Samara, and north-western Ukraine, and it is possible that it may also occur in the Department of Saratov, especially as *Ixodes ricinus*, L., which is the vector in north-western Russia [*R.A.E.*, B **20** 24, etc.], is also present in the south-east. Notes are therefore given on the bionomics of this tick, based on investigations in the Department of Saratov from mid-April to mid-September 1934, with a list of 17 species of animals on which it was found, showing the stages taken on each. Wild animals were the chief hosts, all stages occurring on hedgehogs (*Erinaceus rumanicus*), pole-cats (*Putorius eversmanni*), hamsters (*Cricetus cricetus*) and wolves, and larvae and nymphs also on forest mice (*Apodemus silvaticus*), hares and foxes. Only small numbers, all of which were adults, were taken on domestic animals, chiefly cattle, though single individuals occurred on horses and sheep. The adult ticks were found in May and again from the end of August to October, and the nymphs and larvae from May to the beginning of September. Apparently there is only one generation a year, all stages hibernating, so that one brood of adults occurs in the spring and another in the autumn.

The distribution of *I. ricinus* in the Russian Union is briefly reviewed. An examination of collections of ticks made in different parts of the south-east of European Russia during 1926–34 from a total of 70,000 domestic animals and over 11,000 wild hosts, showed that *I. ricinus* does not occur either in the zone of semi-desert or in the dry steppe, but is only present in low lying damp places near rivers and in ravines [*cf.* **15** 6; **18** 102].

[Zasukhin (D. N.).] **Засухин (Д. Н.). Materials for the Study of the Forms of Piroplasmosis of wild Mammals in the South-east of the R.U.F.S.R. Communication iv.** [*In Russian.*]—*Trud. saratov. nauch.-issledov. vet. Inst.* **3** pp. 155–164, 2 figs., 7 refs. Saratov, 1936.

A brief account is given of investigations carried out in 1934 in and near Saratov on a form of piroplasmosis of hedgehogs (*Erinaceus rumanicus*) caused by *Nuttallia ninense.* The morphology of the parasite and its development in the host are discussed. The ticks found on this hedgehog were *Ixodes ricinus*, L., *Rhipicephalus sanguineus*, Latr., *R. rossicus*, Yak. & Kohl.-Yak., and larvae and nymphs of *Dermacentor silvarum*, Olen., and *D. niveus*, Neum. The two species of *Rhipicephalus* and single individuals of *Haemaphysalis numidiana*, Neum., also occurred on *Hemiechinus auritus*. On comparing the seasonal occurrence of the ticks on *E. rumanicus* and of piroplasmosis, the author concludes that both the larvae and nymphs of the species of *Dermacentor* are the vectors.

In the course of investigations on piroplasmosis of ground squirrels in western Kazakstan in 1929 [*R.A.E.*, B **20** 42], a parasite was found in *Citellus fulvus*, which did not differ morphologically from *Piroplasma kolzovi* as occurring in *C. pygmaeus*, but is here named *P. volgense* sp. n. It is possible that *Rhipicephalus schulzei*, Olen., is the vector, as it was the only tick found on *C. fulvus*.

Minning (W.). **Zur Kenntnis des Genus** *Boophilus* **Curtice ii.** [Contribution to the knowledge of the Genus *Boophilus*.]—*Z. Parasitenk.* **8** no. 3 pp. 365–370, 5 figs., 3 refs. Berlin, 4th March 1936.

A key is given to both sexes of the subgenus *Boophilus* [*cf.* *R.A.E.*, B **22** 253], with descriptions of *B. calcaratus persicus*, subsp. n., *B. intraoculatus*, sp. n., and *B.* (*Uroboophilus*) *occidentalis*, sp. n., from cattle in Persia, and *B.* (*U.*) *indicus*, sp. n., from cattle in Madras.

Stickdorn (H.). **Versuche zur Uebertragung von Rotlaufbakterien durch die Schweinelaus** (*Haematopinus suis*). [Experiments in the Transmission of the Bacteria of Erysipelas by *H. suis*.]—*Z. Parasitenk.* **8** no. 4 pp. 492–503, 18 refs. Berlin, 18th April 1936.

An account is given of a series of experiments to ascertain if *Haematopinus suis*, L., can act as a vector of the bacteria of swine erysipelas. White mice died of this disease following inoculation with the crushed guts of lice that had fed on artificially infected mice, but no transmission was obtained by biting. *H. suis* is, therefore, not a direct transmitter of erysipelas to white mice and this probably holds good for pigs also, though distribution of the bacteria by the louse and its excreta is possible.

Van Volkenberg (H. L.). **Parasites and parasitic Diseases of Swine in Puerto Rico.**—*Bull. P.R.* [*fed.*] *agric. Exp. Sta.* no. 38, 14 pp., 2 figs., 3 refs. Washington, D.C., March 1936. [Recd. June 1936.]

Although several kinds of Arthropods occur on pigs in Porto Rico, they are not considered to be of much importance, and the hardy native pigs exposed to sunlight on the open range seem to be remarkably free from external parasites. Brief notes are given on the incidence and control of *Haematopinus suis*, L. (*adventicius*, Neum.), *Demodex phylloides*, Csokor, *Sarcoptes suis*, Gerl., *Cochliomyia hominivorax*, Coq. (*americana*, Cush. & Patt.), which may infest open wounds, and *Tunga penetrans*, L., which frequently attacks pigs, especially those reared near the seashore. Other Arthropods that have been found on pigs include the horse tick, *Dermacentor nitens*, Neum., in the ear. Species of *Lachnosterna* and a common water beetle, *Tropisternus collaris*, F., are intermediate hosts of *Macracanthorynchus hirudinaceus* (thorny-headed worm), which is an important parasite of pigs [*cf.* *R.A.E.*, B **20** 268], and dung-infesting beetles of *Ascarops strongylina* (strongyline stomach worm).

Harkema (R.). **The Parasites of some North Carolina Rodents.**—*Ecol. Monogr.* **6** no. 2 pp. 151–232, 5 figs., 12 pp. refs. Durham, N.C., April 1936.

Records are given of the parasites obtained from five species of rodents collected in North Carolina in 1933–35, and a list of all the known parasites of North American rodents, including 277 species of Arthropods, is appended.

[Épshteĭn (G. V.) & Sil'vers (I. L.)] Epstein (G. W.) & Silvers (I. L.). **Transmission of Rat Virus to Guinea Pigs through Fleas. Second Preliminary Report.**—*G. Batt. Immun.* **14** pp. 1079–1088, 4 charts, 8 refs. Torino, 1935. (With Summaries in Italian, French and German.)

[Épshteĭn (G. V.), Sil'vers (I. L.) & Ékzemplyarskaya (E. V.)] Epstein (G. W.), Silvers (I. L.) & Exemplarskaya (E. V.). **Searching for Typhus Virus in Moscow Rats (Winter 1934). Third Report.**—*T.c.* pp. 1089–1098, 1 ref. (With Summaries in Italian, French and German.)

The work described was begun in June 1933 to determine whether the typhus virus recently found in rats in Moscow was transmissible by fleas. By December, 1,375 fleas had been collected from 371 rats. *Pulex irritans*, L., was only taken in three cases and *Leptopsylla segnis*, Schönh. (*musculi*, Dugès) in four. Of the fleas used in the experiments 82 per cent. were *Xenopsylla cheopis*, Roths., and the rest *Ceratophyllus fasciatus*, Bosc. To test their infectivity the fleas were either fed on healthy guineapigs, or suspensions made from their intestines were inoculated into guineapigs. An attempt was made to check experiments in which fleas were fed by inoculating other guineapigs with their intestines ; with 5 batches of fleas infection was obtained by both means, with 5 batches infection was obtained by one means or the other, and with 1 batch no infection was obtained by either means. Batches

totalling 245 fleas (of which 74 per cent. were *X. cheopis*) were inoculated in 17 guineapigs, the minimum number of intestines used for one inoculation being 10. In 9 guineapigs the temperature reaction was definite, in 7 it was doubtful and in 1 no reaction occurred. Batches totalling 412 fleas (of which 83 per cent. were *X. cheopis*) were fed on 18 guineapigs, of which 6 gave definite reactions, 5 gave doubtful reactions and 7 did not react. It was noted that when clear reactions were obtained with injections the proportion of *X. cheopis* was 81 per cent., whereas in weak or doubtful reactions it was 60 per cent. Similar results were obtained in the feeding experiments, negative results being obtained in cases where *C. fasciatus* predominated in the batches of fleas. It is concluded that *X. cheopis* is the most important vector of the disease. In previous experiments in which guineapigs were inoculated with emulsions of the brains of rats, positive results were obtained in 32 per cent. A comparison of the virus from fleas with that obtained from rats showed that they were similar, but suggested that the former was more virulent than the latter. The Weil-Felix reaction was positive for nearly all rats from which infective fleas were taken. Rickettsiae were observed in suspensions of intestines of fleas, in histological sections of infective fleas, and in infected guineapigs.

In the second paper, an account is given of the attempt made to continue the study of the typhus virus in rats and fleas from Moscow. Between 15th February and 1st May 1934, 237 rats were examined and 842 fleas (559 *X. cheopis* and 283 *C. fasciatus*), were collected. Although numerous experiments were carried out, including some with fleas similar to those described in the preceding paper, no positive results were obtained. Most of the rats were, however, infected with a pneumococcus [*cf. R.A.E.*, B **24** 176]. Thus it appears that the sudden decrease in the incidence of typhus virus in the rats of Moscow, which probably occurred about the end of 1933, was accompanied by a widespread outbreak of pneumococcus infection.

BLANC (G.) & BALTAZARD (M.). **L'influence du jeûne sur le développement du virus du typhus murin chez la puce** (*Xenopsylla cheopis*).—*C. R. Acad. Sci. Fr.* **202** no. 26 pp. 2191–2192, 2 refs. Paris, 1936.

A guineapig inoculated with crushed fleas (*Xenopsylla cheopis*, Roths.) that had been kept without food for 12 days after feeding on a rat infected with murine typhus did not become infected. When, however, some of the starved fleas were allowed to feed for 10 days on a fresh rat and were then crushed and inoculated into a guineapig, the latter became infected. It is concluded that the virus cannot multiply in starved fleas.

NÁJERA ANGULO (L.). **Investigación de flagelados en el látex de diferentes especies vegetales de la zona de Sigüenza (Guadaljara).**—*Primer Congr. nac. Sanidad 1934, Actas* **4** pp. 195–203, 19 refs. Madrid, 1935. [Recd. July 1936.]

Published work on flagellate and other parasites in plants is reviewed. The author examined in 1933 nine species of plants from the environs of Sigüenza, Spain, but failed to find amoebae, spirochaetes or flagellates in them.

Nájera Angulo (L.). **La** *Onchocerca volvulus* **en Fernando Poo.**—*Primer Congr. nac. Sanidad 1934, Actas* **4** pp. 241–293, 13 figs., 8 pp. refs. Madrid, 1935. [Recd. July 1936.]

From July 1929 to January 1930 the author found cysts of *Onchocerca volvulus* in 121 (19·11 per cent.) of 633 natives examined on the island of Fernando Po. In view of the probable part played by *Simulium damnosum*, Theo., as a vector of *O. volvulus* in Sierra Leone [*R.A.E.*, B **14** 62, 167], over 100 flies of this species caught in Fernando Po were dissected, but microfilariae of *O. volvulus* were found in one only. A negative result was obtained with 25 examples of this Simuliid that were fed on natives harbouring cysts of *O. volvulus*.

Nájera Angulo (L.). **Observaciones sobre los** *Phlebotomus* **recogidos en** [collected in] **Sigüenza.**—*Primer Congr. nac. Sanidad 1934, Actas* **4** pp. 305–316, 13 figs. Madrid, 1935. [Recd. July 1936.]

Nájera Angulo (L.). **Observaciones sobre la espermoteca del** *Phlebotomus ariasi* **Tonnoir, 1921.**—*Med. Países cálidos* **9** no. 7 pp. 308–319, 9 figs., 7 refs. Madrid, July 1936.

In the first paper, the author describes the more important specific characters of *Phlebotomus parroti*, Adler & Thdr., *P. perniciosus*, Newst., and *P. ariasi*, Tonnoir, from 94 males and 186 females collected at Sigüenza, Spain, in 1933, and in the second he discusses in detail the structure of the spermatheca of *P. ariasi*, and compares it with that of *P. perniciosus*.

Gibbins (E. G.). **Uganda Simuliidae.**—*Trans R. ent. Soc. Lond.* **85** pt. 9 pp. 217–242, 24 figs., 9 refs. London, 19th June 1936.

After drawing attention to the increasing importance of Simuliids in the transmission of *Onchocerca* [*cf. R.A.E.*, B **21** 85; **23** 134, 172], the author describes nine species of *Simulium* taken in Uganda, five of which are new. The descriptions include those of the larvae, pupae and adults of both sexes, except in the case of one of the new species, of which the larva is unknown. The breeding places of all species are recorded. Details are also given of the male terminalia and the pupal respiratory organ of *S. adersi*, Pom. [*cf.* **22** 171].

Further observations extending over a period of four years on the range of flight of *S. damnosum*, Theo., tend to show that it disperses even more widely than was thought [*cf.* **21** 206]. During the dry season, in January 1934 and 1935, females invaded Kampala, a town that is 45 miles from the only known breeding place in the River Nile. Both occasions coincided with greatly increased density in the region of the Nile and an abundance of adults in the intervening countryside. All the important rivers and streams in the surrounding country have been searched repeatedly, but, although the early stages of many different species have been found, those of *S. damnosum* were never observed. None of the water courses investigated appears to be sufficiently well aerated for this species [*cf.* **22** 171], with the possible exception of a few square yards at the base of the Sezibwa falls [*cf.* **21** 206]. No larvae or pupae were found there, and, even if breeding occurred, it seems improbable that such a large number of flies could have originated in so small an area and invaded a township some 25 miles distant. Moreover, if the development of the early stages were

possible in the smaller rivers of Uganda, the fly would be abundant everywhere, whereas it is only at periods of great density that it is found so far from its breeding place.

Gnadinger (C. B.). **Pyrethrum Flowers.**—2nd edn, Demy 8vo, xvi+380 pp., frontis., text ill., 991 refs. Minneapolis, Minn., McLaughlin Gormley King & Co., 1936. Price $5·50.

In this second edition of a work already noticed [*R.A.E.*, B **22** 143], data on production and new sources of pyrethrum have been brought up to date, recent work on the isolation of the pyrethrins and on pyrethrum dermatitis is described, and working descriptions of 14 chemical methods for assaying pyrethrum products are included. The decomposition of pyrethrum flowers and extracts in storage and the use of antioxidants to prevent decomposition are discussed. Additional information on live-stock sprays is given. Much new material on the cultivation of pyrethrum in the United States is included in the final chapter, and more than 300 references have been added to the bibliography.

Oosthuizen (M. J.) & Smit (B.). **Electrocuting Insects.**—*Fmg in S. Afr.* 1936 reprint no. 27, 3 pp., 3 figs. Pretoria, March 1936.

Electrically charged screens for killing insects, such as have been used in the United States for several years [*cf. R.A.E.*, B **20** 55; **16** 81; etc.], are now being sold in South Africa, and in this paper the authors describe experiments carried out to test their efficacy. The regular service supply of 220 volts was converted by means of a transformer to one of about 4,000 volts with current of approximately 18 milliampères [*cf.* **19** 261], so that insects would be killed on contact but the device would be harmless to man or animals. The types available are a flat screen to fit over a window in places where flies are abundant or over a flat metal box in which dishes of bait such as milk or meat are placed, or a circular screen round a strong electric light to which flies are attracted. Complete screen doors fitted with electric screens are also available from the factory. Guards to prevent man or animals from coming into contact with the screens, and troughs or trays to collect the dead flies may also be obtained.

At an abattoir at Potchefstrom a screen 18 by 24 inches was fitted in a window through which many flies passed. It was operated for 260 hours of daylight during November and December and destroyed 131,375 examples of *Musca domestica*, L., 3,375 of *Chrysomyia chloropyga*, Wied., 1,601 of *Lucilia sericata*, Mg., 719 of *C. albiceps*, Wied., 24 of *C. marginalis*, Wied., and 184 other insects that were not identified. The highest catch of house-flies between 6 a.m. and 4 p.m. was 3,430, whereas the highest catch in 24 hours was 6,983; it was noticed that many flies tried to gain entrance through the window just before sunset. The comparatively small number of blowflies electrocuted may have been due to the exceptionally dry weather, which decreased their abundance. It is believed that the numbers of insects counted do not accurately represent those killed, and that from 25 to 50 per cent. of those destroyed were lost, being completely burned up, blown out of the collecting trays, or eaten by birds, which visited the trays almost daily. The amount of current consumed was low, the screen being operated for about a month on 2–3 units. The screen

should be especially useful in dairies, abattoirs and buildings on the sewage farms of towns and cities where flies are abundant. It may also be used in dwellings, when in addition to destroying house-flies it will prevent mosquitos entering at night ; moreover, it offers increased ventilation and light as compared with an ordinary screen. The unnecessary sparking and short-circuiting caused by insects lodging between the two electrically charged plates placed across the screen to strengthen it could be remedied by bending the plates outward away from each other.

Two of the lamps surrounded by electrified screens were tested at night in Pretoria on the stoep of a residence. One was fitted with a mercury-vapour tube, which gave a subdued blue light, and the other with a 75-watt frosted bulb, which gave a bright light ; both lights attracted insects, but the white light attracted more, probably because of its greater intensity. In both cases the screens were satisfactory.

HASE (A.). **Ueber Wärmeentwicklung in Massenzuchten von Insekten sowie über ein einfaches Verfahren, Stubenfliegen dauernd zu züchten.** [The Development of Warmth in the Mass-breeding of Insects and a simple Method of continuously breeding House-flies.]—*Zool. Anz.* **112** no. 11–12 pp. 291–298, 1 fig., 1 ref. Leipzig, 15th December 1935. [Recd. July 1936.]

In the mass-breeding of *Calandra granaria*, L., temperatures up to 33·6°C. [92·48°F.] were observed in the centre of the brood contained with wheat grains in a glass cylinder, the room temperature being 22·3°C. [72·14°F.] [*cf. R.A.E.*, A **23** 676, etc.]. In breeding larvae of *Musca domestica*, L., with a few larvae of *Fannia* and *Drosophila* intermingled, a maximum temperature of 42°C. [107·6°F.] was noticed, this being 18·5°C. [33·3°F.] more than the room temperature. The larvae were in tins, and in all cases the containers were teeming with insects. Probably the activity of the insects was one of the causes of the high temperature, but a fully satisfactory explanation was not forthcoming. It was remarkable that in all cases the insects seemed in a very flourishing condition.

For breeding *M. domestica* and other flies occurring in houses, the author makes use of tins with the bottoms perforated like a sieve. In this way superfluous water can fall into dishes placed beneath and larvae can pass downwards into them. The dishes are filled with sand and peat or sand and wood-shavings to absorb moisture and afford the larvae suitable conditions for pupation. The bottom of the dish can be covered with filter paper or other absorbent material. The tins are filled with coffee grounds in which are placed pieces of cheese, one or two pieces being allowed to protrude from the grounds to attract the female flies. The tins are left in a room or stable, but not in direct sunlight. After 4–6 days the contents can be emptied to see how many larvae there are. They feed largely in the coffee grounds, from which they can be washed out.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Essai de transmission de** *Tryp. gambiense* **par** *Gl. palpalis* **à l'Institut Pasteur de Paris.**—*Bull. Soc. Path. exot.* **29** no. 5 pp. 500–504, 1 fig., 5 refs. Paris, 1936.

Experiments are described in which about 100 females of *Glossina palpalis*, R.-D., recently emerged from pupae sent from Uganda to

Paris, were allowed to feed on 3rd, 4th and 6th January on a guineapig infected with a strain of *Trypanosoma gambiense* that had been maintained in guineapigs since 1934, and between 7th January and 26th February on six healthy guineapigs in succession. None of the latter became infected. The rate of mortality among the flies was not much higher than in tropical laboratories, and many were kept alive for more than a month, a period sufficient to permit the cyclical development of the trypanosome. Examination of 51 flies that had survived at least 10 days after the infecting feed showed only one containing parasites, and these were confined to the mid-gut. This fly had died 28 days after the first infecting feed. The results indicate that this strain of *T. gambiense* was not cyclically transmissible.

GALLIARD (H.). **L'antropophilie de** *Culex fatigans* **au Tonkin.**—*Bull. Soc. Path. exot.* **29** no. 5 pp. 517–518, 1 ref. Paris, 1936.

It has been stated that in the laboratory at Dakar *Culex fatigans*, Wied., fed exclusively on birds [*R.A.E.*, B **23** 256], and the author suggests that this may indicate the existence of a biological race. In Gabun (French Equatorial Africa) in 1930, he recorded the aggressiveness with which this species attacked man at the beginning of the rainy season, and at Hanoi (Tonkin) *C. fatigans* and *Armigeres obturbans*, Wlk., are the two domestic mosquitos that attack man most avidly [*cf.* **24** 82]. Moreover, *C. fatigans* is the only species that remains active to some extent during the cold season, making the use of mosquito nets necessary throughout the year, at least in certain quarters of the town. Females have been observed to engorge under natural conditions during nights when the temperature in houses has not risen above 10°C. [50°F.]. As biological characters change completely in the laboratory, it is impossible to judge whether an insect is anthropophilous or zoophilous from its behaviour under experimental conditions. Reared females of *C. fatigans* only bite at temperatures in the vicinity of 25°C. [77°F.] and then attack man, guineapigs or birds indiscriminately, or may refuse to bite man. Adults that had been kept for two months at temperatures ranging from 12 to 15°C. [53·6–59°F.] refused to engorge in man or animals unless placed directly on the skin. At the end of 5 or 6 generations females of certain strains of *C. fatigans* and *A. obturbans* lose their ability to feed on animals and must therefore be fed on man.

Thus the scarcity of cases of filariasis in Indo-China cannot be explained by the fact that *C. fatigans* does not attack man. The rarity of microfilariae in the peripheral blood of the carriers examined and the relatively few parasites that reach maturity in the intermediate host suggest that the number of mosquitos infected must be extremely low.

ISAAC (P. V.). **Report of the Imperial Entomologist.**—*Sci. Rep. imp. Inst. agric. Res. Pusa 1933–34* pp. 168–174. Delhi, 1936.

Reference is made (p. 172) to an outbreak of surra in cattle at Karnal in 1933 [*cf. R.A.E.*, B **23** 270]. Tabanid larvae obtained from the farm on which it occurred and reared in the laboratory proved to be *Tabanus virgo*, Wied., and *T. tenens*, Wlk.

Corson (J. F.). **Experimental Transmission of *Trypanosoma rhodesiense* by *Glossina morsitans* from Man to Sheep and back to Man.**—*J. trop. Med. Hyg.* **39** no. 11 pp. 125–126. London, 1st June 1936.

Previous experiments [*cf. R.A.E.*, B **23** 65] have shown that *Trypanosoma rhodesiense* may retain its infectivity for man after living in the bodies of domestic and wild animals, but one or more of the passages have been made by syringe and one or more small laboratory animals have been used in the series of passages. In the present experiments these objections were eliminated.

On 1st October 1934 about 200 laboratory-bred examples of *Glossina morsitans*, Westw., were allowed to feed once only on an untreated case of Rhodesian sleeping sickness. They were then fed on a sheep until 6th November, when they were fed on two monkeys, which showed infection on 12th and 15th November respectively. The flies (172) were then fed separately on rats and four infective ones were thus isolated. One of these was fed on a sheep on 11th December and transmissions were then made through four more sheep by means of flies without isolation of the trypanosome until November 1935, when flies that had fed on the last sheep of the series were isolated and the salivary glands of one of them were injected into a sixth sheep on 30th December. Flies fed on this sheep, after infecting a seventh, were then isolated and one of the seven infected flies separated transmitted the infection to man.

Cawston (F. G.). **Some Observations on *Opuntia* used as a Larvicide.**—*J. trop. Med. Hyg.* **39** no. 12 pp. 137–138, 1 ref. London, 15th June 1936.

As successful results have been reported from the use of chopped leaves of *Opuntia vulgaris* in the control of mosquito larvae in Algeria [*R.A.E.*, B **22** 233], laboratory experiments were undertaken in Natal to test the effect of the leaves of *O. maxima* against the larvae of *Culex fatigans*, Wied., and several species of *Anopheles*. An infusion was made by pouring 1 pint boiling water on 16 oz. fresh leaves cut into small pieces, steeping for 5 hours and then straining the liquid through gauze. This mucilaginous material or freshly chopped leaves were added in various proportions to water containing both larvae and pupae. The infusion obtained from *O. maxima* is slightly heavier than water and gradually mixes with it, forming a sediment on the bottom when it decomposes. It is therefore concluded that it could have but a limited value in the destruction of surface life in natural pools of water. Concentrated infusion had a rapid and largely lethal effect on the larvae but little effect on the pupae. Young larvae of both *Culex* and Anophelines were destroyed, but more developed larvae sometimes recovered and eventually reached the adult stage. The larvicidal effect would appear to be largely mechanical.

Corson (J. F.). **A Note on Hyrax and Dikdiks** (*Rhynchotragus*) **from Areas inhabited by Tsetse Flies.**—*J. trop. Med. Hyg.* **39** no. 12 p. 138. London, 15th June 1936.

The rock-dwelling species of hyrax and small antelopes (dikdiks) obtained from tsetse-free districts are known to be very susceptible to infection with *Trypanosoma rhodesiense* [*cf. R.A.E.*, B **20** 124; **23** 65],

yet they are plentiful in places where tsetse flies are fairly numerous and are reported to be common in areas where sleeping sickness occurs. The question arises, therefore, whether these animals have acquired some resistance to infection or whether they are actually less exposed to it than they appear to be.

During August 1934, 42 hyrax were caught in an area in Tanganyika where *Glossina swynnertoni*, Aust., was fairly numerous and trypanosomiasis had occurred in cattle, sheep and goats. A thick blood film was made and a rat was inoculated from each hyrax, and in most cases the latter was then inoculated with the blood of a rat infected with *T. rhodesiense*. None of the blood films showed trypanosomes and none of the rats became infected during an observation period of one month. All the 29 hyrax that lived long enough became infected and rats inoculated from them contracted the disease. Examination of the cerebrospinal fluid of some of the hyrax revealed living trypanosomes in two cases. Similar experiments were carried out with hyrax obtained from the vicinity of a sleeping sickness settlement where *G. morsitans*, Westw., was abundant. No blood films showed trypanosomes and no inoculated rats became infected, but four hyrax that were bitten by flies infected with *T. rhodesiense* and four that were inoculated from a rat infected with the same trypanosome contracted the disease. Similar results were obtained with six dikdiks treated in the same way, although three of the six died after inoculation with *T. rhodesiense* before their blood could be examined. The three others became infected. Rats subinoculated from two of these became infected but no trypanosomes were seen in the cerebrospinal fluid of the two infected dikdiks examined. The results indicate that the hyrax are less exposed to the bites of tsetse flies than casual observations on their habits would suggest. No conclusions are drawn from the small number of observations on dikdiks.

SAUNDERS (G. M.), KUMM (H. W.) & RERRIE (J. I.). **The Relationship of certain Environmental Factors to the Distribution of Yaws in Jamaica.**—*Amer. J. Hyg.* **23** no. 3 pp. 558–579, 6 maps, 14 refs. Baltimore, Md, May 1936.

The present distribution of yaws in Jamaica, as determined by inspection trips, surveys in widely separated areas, and replies to questionnaires sent to schools, has been found to be essentially the same as it was 20 and 40 years ago. The fact that the disease has remained confined to certain sharply defined areas, although it has undoubtedly been introduced repeatedly into all parts of the Island, suggests that there are factors favouring or limiting its spread, and in the present paper the relation of its incidence to rainfall, geology, topography, rural and urban areas, the sanitary status of the population and the presence of flies of the genus *Hippelates* [*cf. R.A.E.*, B **23** 274] is discussed. Rainfall seems to be of importance, either as affecting the disease directly, causing more lesions to appear, or indirectly by favouring dense vegetation, which may provide suitable breeding places for insect vectors, increase the likelihood of injuries to the feet and lower part of the legs (where the primary yaws lesions nearly always appear) or maintain the viability of the infecting spirochaete outside the body. The underlying geological formation also seems to be important, as the disease is scarce or absent in areas of porous white limestone, either because the ground dries very rapidly or because there is usually

poor surface soil and scant vegetation, and is common in most places where there is a relatively impervious formation, with productive soil, ample precipitation and a jungle type of flora. Altitude appears to have little direct effect, but may have an indirect one, because rainfall tends to be greater over hills than over low-lying plains. The sanitary status of the country peasants is essentially the same throughout the island, but in districts where yaws is found it is commonest among persons with a low standard of living. It is less prevalent in the villages and towns than in the surrounding country, possibly because the people have a slightly higher standard of living or because the vegetation is scantier. Wherever the incidence was high, *Hippelates pallipes*, Lw., was abundant ; as a rule the converse was true, although there were places where the flies were numerous and the disease absent [*cf. loc. cit.*]. In comparing the incidence of yaws with the fly catches in adjoining urban and rural areas, it was found that although the disease was commoner in the latter, the fly catches were similar in both. It has not yet been decided whether the distribution of *H. pallipes* in Jamaica determines the distribution of yaws, or whether both are affected by the same environmental factors, which cause their distribution to coincide.

KUMM (H. W.) & TURNER (T. B.). **The Transmission of Yaws from Man to Rabbits by an Insect Vector,** *Hippelates pallipes* **Loew.**—*Amer. J. trop. Med.* **16** no. 3 pp. 245–262, 5 pls., 17 refs. Baltimore, Md, May 1936.

In this paper the authors describe the technique used and the results obtained in experiments carried out at Kingston, Jamaica, on the transmission of *Spirochaeta* (*Treponema*) *pertenuis* from man to rabbits by means of *Hippelates pallipes*, Lw., either by dissecting out the oesophageal diverticula of flies that had fed to repletion on infectious lesions on man and transferring them to wounds on rabbits, or by collecting flies that had fed on similar lesions and allowing them to continue their feed on rabbits. In later experiments when the importance in infection of the regurgitation of a " vomit drop " [*cf. R.A.E.*, B **23** 275] became more evident, it was realised that the flies must be allowed to feed on the experimental animal for a considerable time, and feeding chambers, which are described, were substituted for the glass tubes containing individual flies that were originally used. As the natural resistance of rabbits is apparently influenced by seasonal or climatic factors, a number of the experimental animals were sent to New York during the incubation period in an attempt to decrease their resistance. In 33 cases in which flies had fed on or been inoculated into old granulating wounds on the backs of rabbits that were kept during the incubation period in Jamaica, the results were all negative, but when animals with the same type of wound were sent to New York, 2 out of 7 of those inoculated and 3 out of 20 of those on which flies had fed showed positive lesions. When the wounds consisted of freshly scarified areas on the scrotum and the rabbits were kept in Jamaica, 4 out of 11 of those inoculated and 4 out of 21 of those on which flies had fed gave positive results, and both the 2 rabbits with the same type of wound that were sent to New York also developed yaws. In the inoculation experiments all flies but *H. pallipes* were discarded, but in feeding experiments it was necessary to use insects that came to feed on yaws lesions naturally

and preliminary identifications had to be made with the naked eye; although most of the flies were *H. pallipes*, a few belonged to other species. However, in one positive experiment the flies were all identified microscopically after feeding as *H. pallipes*, thus proving that this species alone can transmit the disease. In positive feeding experiments the number of flies used varied from 30 to 55 and the length of time they were left in contact with the wound from 1 to 3 hours. The numbers of oesophageal diverticula inoculated varied from 1 to 32, and the result of one of the experiments in which only one was used was positive. To ascertain whether the flies were likely to carry the spirochaetes on their legs and feet, 12 flies that had fed on lesions and walked in the infectious serum had their legs and feet and their digestive tracts removed separately; although all the digestive tracts contained actively motile spirochaetes, none was observed in emulsions made from the legs and feet.

Simmons (J. S.), Reynolds (F. H. K.) & Cornell (V. H.). **Transmission of the Virus of Equine Encephalomyelitis through** *Aëdes albopictus*, **Skuse.**—*Amer. J. trop. Med.* **16** no. 3 pp. 289–302, 10 refs. Baltimore, Md, May 1936.

An account is given of experiments carried out at Washington, D.C., in 1934 on the transmission of the virus of equine encephalomyelitis of the western type from infected to healthy guineapigs by means of *Aëdes albopictus*, Skuze. This mosquito, which is a common, semi-domestic oriental species, is not indigenous in the Western Hemisphere, and there is no evidence that it has any connection with the natural dissemination of the disease, but material was available and, in view of the fact that it had been shown capable of transmitting dengue [*cf. R.A.E.*, B **19** 110] and yellow fever [**18** 82], it was thought that it might also transmit encephalomyelitis. As the primary object of the investigation was to test the possibility of biological rather than mechanical transmission, guineapigs that had been inoculated intracutaneously or intracranially with the virus were subjected on the six following days to the bites of six successive lots of 100 females of *A. albopictus*, which were subsequently allowed to feed after intervals of 7–38 days on normal guineapigs. All these animals died after intervals of 4–29 days. It seems probable that they died of encephalomyelitis, but specific neutralisation tests and pathogenicity tests in normal and immune animals were carried out only with tissues from animals bitten by mosquitos from three of the six lots, so that the results can only be considered as definite proof that the virus was transmitted by one or more of these three lots.

Hinman (E. H.). **Preliminary Observations on the "Hibernation" of** *Anopheles quadrimaculatus* **in southern Louisiana.**—*Sth. med. J.* **27** no. 5 pp. 461–464, 12 refs. Birmingham, Ala., May 1934. **Studies upon the Problem of Races of** *Anopheles quadrimaculatus* **Say in the United States.**—*Amer. J. trop. Med.* **16** no. 3 pp. 303–309, 10 refs. Baltimore, Md, May 1936.

In the first paper the author records observations during 1931–33 on the activity of adults of *Anopheles quadrimaculatus*, Say, in a deserted fort in southern Louisiana. Adults were seen during the spring and summer months, but their numbers were insignificant

when compared with the enormous numbers observed in November. The highest concentration of females was reached in late November or early December, and from that time their numbers gradually declined until the latter part of January, when dispersal took place. At this time no males were found, and the females showed little or no evidence of having taken blood-meals or of marked ovarian development. Only a few larvae were observed in neighbouring breeding places, so that most of the dispersed females would appear to have migrated for some distance, a fact that may account for the sudden appearance of adults of this species where no larvae have previously been observed. A few larvae were found throughout the winter in the moat. In late February only small numbers of adults were seen in the fort and in March they had almost disappeared.

These observations do not accord well with the established theory that in the southern part of the United States Anophelines continue to be active throughout the winter and that there is no true hibernation [*cf. R.A.E.*, B **12** 73; **17** 174; etc.]. Although other old forts and various unoccupied buildings in the region of New Orleans were visited at various seasons, no further evidence was obtained of such concentrations of females over a long hibernating period. It is suggested that further research will reveal additional places where this occurs, or that there is variation within the species from continuous activity throughout the winter to this unusual instance of suspended activity.

In the second paper, the author states that continued observations in the same locality for a further period of two years confirmed the previous ones. In two out of the five summers a secondary increase in the numbers of adults was observed in June or July. This may have been due to unusually heavy oviposition in neighbouring breeding places, although no comparable numbers of larvae were found. On these occasions large numbers of males were present, in contrast to their absence during the winter months.

The question of subspecies among Anophelines is briefly reviewed. As no characters distinguishing the eggs, larvae or adults of the hibernating type from those obtained in other regions have been observed, the author concludes that it does not represent a separate subspecies.

BOYD (M. F.), STRATMAN-THOMAS (W. K.) & KITCHEN (S. F.). **Modifications in a Technique for the Employment of naturally induced Malaria in the Therapy of Paresis.**—*Amer. J. trop. Med.* **16** no. 3 pp. 323–329, 4 refs. Baltimore, Md, May 1936.

The authors describe the modifications that have been made since 1932 in the routine procedures used in the employment of naturally induced malaria for the therapy of paresis [*cf. R.A.E.*, B **21** 73]. For several years all mosquitos have been supplied by the insectaries [*cf.* **23** 283] and no wild examples have been needed. Routine work is carried out exclusively with *Anopheles quadrimaculatus*, Say, which is more susceptible to the various malaria parasites than *A. punctipennis*, Say. A supply of approximately 200 uninfected females is constantly kept in cold storage in the laboratory, and, if not utilised, is renewed every two weeks. While in storage the mosquitos are fed exclusively on 10 per cent. glucose solution. The species and strains of *Plasmodium* used for the treatment of white and negro patients are discussed.

A minimum density in the blood of a patient of 2 male and 2 female gametocytes per 100 leucocytes in the case of *P. vivax*, and a higher density (up to 10) in that of *P. falciparum* is usually sufficient to ensure a high qualitative infection [*cf.* **21** 73] in mosquitos. It is considered desirable to prove the maturity of the gametocytes by demonstrating the ex-flagellation of the micro-gametocytes before applying the mosquitos to be infected. It has been found since using laboratory-bred instead of wild mosquitos that heavy quantitative infections are well tolerated [*cf.* **21** 73], and endeavours are now made to secure these rather than to avoid them. Mosquitos incubating the sporogonous cycle are stored at a temperature of about 20°C. [68°F.] with a relative humidity of about 85 per cent.; the mortality among them is usually insignificant. Although incubating mosquitos can be satisfactorily fed on glucose solution, they are always fed on a rabbit because of the uncertainty that exists as to the ultimate effect on the strains of parasites of long continued exposure in successive mosquito passages to products of an exclusively carbohydrate metabolism. Mosquitos containing sporozoites of *P. vivax* and *P. falciparum* have not been found to remain infective for more than 50 and 40 days respectively after the completion of the extrinsic incubation period, and results are not reliable after 30 and 20 days. The number of infected mosquitos applied to a patient has been increased to 4 of those infected with *P. vivax* and 6 or 8 of those infected with *P. falciparum*. The management of cases of induced malaria and the effect on treatment of acquired homologous immunity are discussed.

HACKETT (L. W.). **Biological Factors in Malaria Control.**—*Amer. J. trop. Med.* **16** no. 3 pp. 341–352, 12 refs. Baltimore, Md, May 1936.

The author traces briefly the evolution of modern methods of malaria control based on knowledge of the habits of the species or races of the Anopheline vectors. The question of naturally zoophilous and naturally anthropophilous races, and the circumstances under which they transmit malaria is discussed [*cf. R.A.E.*, B **24** 114]. Various theories that have been put forward to explain the transmission of malaria under particular conditions are outlined, together with the facts that render them untenable. The author urges a more profound study of the physiology and instinctive behaviour of Anophelines, and points out that little is known about the essential conditions that make a breeding place attractive to a given race. He suggests that the rôle of larvicidal fish has been misunderstood, for although their immediate effect may be small, their cumulative effect over a long period may be to reduce the Anopheline density below the figure necessary for malaria transmission. He gives examples of the substitution of dangerous races by harmless ones as a result of changes in the water of breeding places brought about by agricultural measures or, over a period of years, by land reclamation.

HANSON (H.). **Some Observations on Dengue.**—*Amer. J. trop. Med.* **16** no. 3 pp. 371–375, 8 refs. Baltimore, Md, May 1936.

A brief account is given of the epidemic of dengue that occurred in Florida in 1934. The control measures consisted in eliminating the breeding places of *Aëdes aegypti*, L., the only known vector in the

United States. Among the types of receptacles holding fresh water in which larvae were found, abandoned motor tyre casings were one of the most important.

O'Connor (F. W.) & Beatty (H.). **The Early Migrations of** *Wuchereria bancrofti* **in** *Culex fatigans*.—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 1 pp. 125–127, 1 pl. London, 30th June 1936.

In the course of dissections carried out on the Island of St. Croix, Virgin Islands, larvae of *Filaria* (*Wuchereria*) *bancrofti* have been repeatedly observed in the anterior part of the mid-gut of females of *Culex fatigans*, Wied., caught in nature. To determine the possible significance of this, dissections of reared females were made immediately and at hourly intervals after they had fed on an infected man.

The following is taken largely from the authors' summary: After 45 minutes ex-sheathed larvae of the parasite are seen outside the stomach, having apparently passed through the undamaged wall of the viscus to enter the abdominal cavity. After 2 hours they are seen in the thorax. After 10 to 18 hours (possibly longer or shorter according to climatic conditions) larvae congregate in large numbers and are found to be very active in the anterior part of the mid-gut. Reversed peristalsis of the viscus may play a part in the movements of the parasites along this structure. Penetration through the walls of the mid-gut to the exterior has been observed. Thus the ex-sheathed larvae from the stomach may reach the thorax through the abdomen, or later, and probably in larger numbers, through the anterior part of the mid-gut. By modifying well-known methods of dissection and staining, a technique (which is described) has been devised by which permanent preparations have been made illustrating some of the foregoing facts.

King (W. V.) & Baisas (F. E.). **A new Species and a new Variety of Philippine** *Anopheles* **related to** *Anopheles leucosphyrus* **Dönitz.**—*Proc. ent. Soc. Wash.* **38** no. 5 pp. 79–89, 14 figs., 4 refs. Washington, D.C., June 1936.

Descriptions are given of the larvae and adults of both sexes of *Anopheles cristatus*, sp. n., and *A. leucosphyrus* var. *riparis*, n., collected on the Island of Mindanao, Philippines. Larvae of the former were taken only in holes in the rock formation in the bed of a small stream, chiefly in the dense shade of overhanging vegetation; those of the latter were found not only in rock holes but in other types of pools left in stream beds by receding water or between boulders at the edge of the stream. The characters distinguishing these mosquitos from allied species and varieties are discussed, and keys are given to the adults and larvae of *A. cristatus*, *A. leucosphyrus*, Dön., and its varieties *hackeri*, Edw., and *riparis*.

Reuter (J.). **Oriënteerend onderzoek naar de oorzaak van het gedrag van** *Anopheles maculipennis* **Meigen bij de voedselkeuze.** [A preparatory Investigation on the Cause of the Behaviour of *A. maculipennis* in the Choice of Food.]—Proefschr. Rijksuniv. Leiden 118 pp., 6 figs., 5 pp. refs. Leiden, 1936. (With a Summary in English.)

A given species or race of Anopheline can be of importance as a vector of malaria only if it maintains constant contact with man, as otherwise it is likely to inoculate the sporozoites into animals. The

reasons for a mosquito being zoophilous or anthropophilous have not been ascertained. The present thesis records work in Holland investigating whether food preferences exist and what stimuli induce feeding. The varieties of *Anopheles maculipennis*, Mg., used were *atroparvus*, van Thiel, and *labranchiae*, Flni., the first being known as zoophilous and the second as anthropophilous. The literature on food preferences of Anophelines is surveyed.

The author's experiments were made under the direction of P. H. van Thiel [*R.A.E.*, B **24** 91] and were exploratory in character, for a definite judgment would require many other tests and also comparisons with other species of mosquitos. The period of maximum activity (including feeding) of *atroparvus* was so short as to render it undesirable to devote any part of it to developing an appropriate technique, and for this reason preliminary tests during the semi-hibernation period of *atroparvus* were made with laboratory bred females of *Aëdes aegypti*, L., to find the stimuli causing them to seek blood. The technique thus worked out appeared suitable for *atroparvus* and was used during its active period.

The females of *A. aegypti* were collected by introducing an arm into the breeding cage and were then immediately removed from the arm before they had sucked more than a negligible quantity of blood. The tests were made with an " imitation arm " fitted to one side of an iron gauze cage, so as to project horizontally into the interior. It consisted of a glass cylinder 18 inches long and 2 inches in diameter. Warm water, mixed to the desired temperature from cold and hot pipes, flowed into the cylinder at its outer end and was taken away at the inner end, the outflow pipe being bent downwards and back parallel to the cylinder until outside the cage beneath the inflow pipe. Two strips of filter paper about 2½ inches wide were hung on the arm so as to provide a rough surface. In tests on the effects of humidity and odours one strip was moistened with distilled water and the other with a solution of odoriferous substances. The outer surface of the paper was kept at 30–35°C. [86–95°F.], approximating to the temperature of the human arm.

The various acids in human sweat did not attract *A. aegypti*. Moisture was distinctly attractive, and warmth was essential to induce feeding. When the water in the cylinder was at about 25°C. [77°F.] the mosquitos were quiet ; they became active when it was at about 28°C. [82·4°F.].

For the experiments with *atroparvus*, the females were captured in pig-sties, and 50–75 were placed in the cage daily. Warmth was the foremost requirement, the mosquitos flying up and settling on the paper, which they tried to puncture, when water at 30–40°C. [86–104°F.] was passed through the cylinder. Moisture did not attract *atroparvus* so much as *A. aegypti*. No preference for any colour was observed with wet or dry white, grey or red papers. Tests were made with acids, human sweat, cotton wool rubbed on the skin of man and pig, pig faeces, skatol, indol, ammonia, human and pig blood, and with a human arm. The only distinct stimuli were produced by human and pig blood and pig faeces. It appeared very probable that temperature by itself was sufficient to cause feeding. In most tests *atroparvus* preferred the blood of pig to that of man, but sometimes the blood of a particular man was more attractive.

Other experiments were made in which *atroparvus* was given the whole evening and night in which to make a food choice. The special cage

used is described and the results are tabulated. There did not seem to be any definite food preference nor any attraction by sweat or the acids in sweat. In yet other experiments the females were placed in a cage midway between a wooden box containing a pig and one containing a man. The cage communicated with each box by means of a length of stove pipe, and the mosquitos were given the whole evening and night to make their choice. The results are recorded in detail. The pig was generally the more attractive, but individual attractiveness varied greatly. The choice appeared to depend primarily on temperature and to a less degree on air humidity. If the temperature stimulus was insufficient, an increase of humidity could reinforce it, but temperature was always required. In view of tests with an odourless attractant and of the fact that with an increase of humidity man could become as attractive as a pig, it appears that odour plays little if any part. It is suggested that the attractiveness of the pig is due to the enhanced warmth and humidity produced by it as compared with man, and that the character of a house or animal shed must be of importance.

The same apparatus was used with var. *labranchiae* in experiments to test whether its reputed preference for feeding on man really existed. The mosquitos were bred from eggs received from Rome in July and August 1935. They did not appear to show a preference for man.

In observations on *atroparvus* in the field, the mosquitos leaving and entering a pig-sty were counted, and the temperature and humidity were recorded. The mosquitos were most active between half an hour before and half an hour after sunset. At first they left the sty and later they sought to enter. They need stimuli in order to find food, and enter a pig-sty in the morning not primarily to find a host but for shelter. The temperature and humidity of the air streaming out of houses and sheds at the time of maximum activity are greater than that of the outer air, and these two factors probably suffice to attract *atroparvus* inside. The "malariousness" of small working class dwellings with many inmates is ascribed to the many mosquitos found there and to the ease with which a few mosquitos can infect several persons.

[SHIPITZINA (N. K.).] **Шипицина (Н. К.). Les collections d'eau de la plaine littorale du Daghestan et leur rôle malariogène.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 3–23, 1 map, 1 graph, 17 refs. Moscow, 1936. (With a Summary in French.)

An account is given of the results of a survey made in August and September 1933 of the breeding places of Anophelines in the coastal zone along the Caspian Sea, south of the town of Makhach-Kala [*cf. R.A.E.*, B **18** 254; **23** 114, 167]. Tables show the distribution and abundance of the adults of the different species in various shelters, and of the larvae in the different types of water reservoirs.

Anopheles sacharovi, Favr, which the author regards as a race of *A. maculipennis*, Mg., is the chief vector of malaria. It was the predominant species in August and September, and the larvae occurred in practically all types of breeding places, including pools with brackish water, or polluted with organic débris [*cf.* **23** 167]. The adults were common in most of the daytime shelters, whereas those of *A. maculipennis maculipennis* and *A. maculipennis messeae*, Flni., were scarce and only occurred in animal quarters made of stone and earthen

cellars, where the temperature was lower and the humidity higher than in houses. Only a few larvae of these two races were found, those of *maculipennis* being taken in a fresh water spring, and those of *messeae* in a swamp formed by a flooded irrigation ditch.

[Markovich (N. Ya.).] **Маркович (Н. Я.). Gîtes larvaires du pays plat de la Grande Kabarda (Caucase du Nord).** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 24–40, 1 map, 1 graph, 2 figs., 7 refs. Moscow, 1936. (With a Summary in French.)

Investigations on the breeding places of Anophelines were carried out in May–October 1934 in the plain of Great Kabarda in North Caucasus. The natural accumulations of water along the banks of the river Terek, and the artificial ones, such as irrigation ditches, rice-fields, ponds and pits in quarries, are described. Larvae were found from mid-April to the end of October, occurring earliest in water near villages. The temperature and humidity are such that mosquitos are active and attack man throughout the season from the second half of April until September–October. The Anophelines found were *Anopheles maculipennis maculipennis*, Mg., *A. maculipennis messeae*, Flni., *A. hyrcanus*, Pall., *A. claviger*, Mg. (*bifurcatus*, auct.), which was rare, and *A. plumbeus*, Steph., of which only a single individual was taken. The two races of *A. maculipennis* were abundant and widely distributed, and thus appeared to be the chief vectors of malaria, several endemic foci of which were found in spite of the absence of *A. maculipennis labranchiae*, Flni., and *A. sacharovi*, Favr (*elutus*, Edw.). They left their hibernation quarters in April and were active in dwellings from June to October, except during a temporary spell of cold weather in September, when they congregated in reed sheds and cellars. The larvae were abundant in streams, provided that the current was not swift, and in various types of standing water containing dense submerged vegetation; they also occurred in disused wells, and in receptacles in which water was stored. Larvae of *A. hyrcanus* were also numerous in large ponds and in a flooded area with abundant aquatic vegetation.

[Kupriyanova (M. A.) & Martzinovskiĭ (V. I.).] **Куприянова (М. А.) и Марциновский (В. И.). L'influence de la lutte contre les anophèles adultes sur l'endémie palustre dans les tourbières.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 41–46, 6 graphs, 6 refs. Moscow, 1936. (With a Summary in French.)

Details are given of preliminary experiments carried out in 1935 in a sedge peat district in the Department of Moscow to ascertain the effect of systematic destruction of adult Anophelines on the incidence of malaria. Of 4 villages in which conditions of population, malaria incidence and situation were comparable, the first served as a control, in the second only the hibernating mosquitos were destroyed, in the third only those found in cow-sheds and latrines, and in the fourth only those occurring in the huts. The only Anopheline found was *Anopheles maculipennis messeae*, Flni.; of 501 examples dissected, none was infected. The percentages of primary cases of malaria in May, July and September, respectively, were 2·4, 4·2 and 1·7 in the first village, 4·3, 1·8 and 0·5 in the third, and 6·1, 3·1 and 0·3 in the fourth. Thus the greatest reduction in the incidence of the disease occurred where the mosquitos were

systematically destroyed in the huts, this being in spite of the presence of large numbers in the fields. The destruction of the mosquitos in hibernation quarters alone had no effect on their abundance in the spring and summer, as they appeared in numbers from unknown shelters. It was found that they were more numerous in cow-sheds than in workmen's huts, but some migrated from the former to the latter during cold days and nights.

[PODGURSKIĬ (P. F.).] **Подгурский (П. Ф.). Plantage des arbres au bord des collections d'eau comme mesure antianophélienne.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 47–51, 6 refs. Moscow, 1936.

Previous workers [*R.A.E.*, B **13** 109; **19** 191] have found that the larvae of *Anopheles maculipennis*, Mg., are scarce or absent in water that is shaded by vegetation growing on the banks and this was confirmed by observations in the Department of Moscow in 1931, when the number of larvae per square yard of the water in a pond in a forest was only half of that in breeding places outside the forest, and the respective rates of survival were 39 and 64 per cent. The frequent absence of the larvae from water in forests is probably due to the accumulation in it of decomposing organic matter, such as fallen leaves, and to the effect of the shade in reducing its temperature and the development of submerged aquatic plants. Moreover, the vegetation on the banks drains the soil and thus prevents the formation of swamps. It is suggested, therefore, that trees and shrubs should be planted along or round the banks of waters to render conditions unfavourable for the larvae. They should be tall enough to throw a long shadow on the water and sufficiently dense to prevent flooding by streams resulting from rain. They should be arranged in rows to cover a strip 33 to 66 ft. wide. In each row the trees and shrubs should alternate, at a distance of about 2½ ft. one from another, and the distance between the rows should be 4 ft. A list of species that would be suitable for planting in the steppe zone of European Russia is given, and costs of labour and material are estimated.

[KULAGIN (S. M.) & MARTZINOVSKIĬ (V. I.).] **Кулагин (С. М.) и Марциновский (В. И.). Essai d'acclimatation des** ***Gambusia*** **dans les étangs réfrigérants d'une centrale électrique.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 52–61, 1 diagr., 28 refs. Moscow, 1936. (With a Summary in French).

An account is given of the breeding of *Gambusia* in one of a series of artificial ponds constructed for an electric power station near Moscow. The water is supplied from a natural lake fed from the adjoining peat swamp; it enters coolers in the power station and is released in a warm state into the ponds, which are connected with one another, each covering an area of about 20 acres and being about 6½ feet deep. The minimum temperature of the water in the ponds in 1935 varied from 0°C. [32°F.] in March to 21°C. [69·8°F.] in July, and the maximum from 6°C. [42·8°F.] in January to 36°C. [96·8°F.] in July. During the winter of 1934–35, the water did not freeze over, though temperatures in December and January were as low as −24 and −32°C. [−11·2 and −25·6°F.]. The water showed a high content of oxygen and a high active reaction. For breeding *Gambusia* a section of 22 sq. yds. was partitioned off in one of the ponds in a place with abundant vegetation

in the water and on the bank, and several thousand fish obtained from the Caucasus were liberated there in July and September 1934. The fish multiplied in large numbers until November, when they were carried away into the peat swamp owing to the accidental flooding of the ponds. A few, however, were found in December in one of the connecting channels in which the water had a temperature of 24°C. [75·2°F.], and in the following March they reappeared in one of the ponds, becoming abundant by the end of May.

The presence in the water of potassium hydroxide, which was used ten times a year to wash condensers, the total quantity employed amounting to about 1 ton, did not affect *Gambusia*, though some of the large fish of other species living in the ponds died.

In 1935 the young were produced until the end of October, and probably each overwintered adult female gave rise to at least 7 broods of 75–100 fish. In the course of the summer females of the first and second broods also produced offspring. High temperature accelerates sexual activity in *Gambusia* and the development of the young in gravid females, the intervals between broods being decreased to 3 weeks. In aquaria, with a constant temperature of 24–26°C. [75·2–78·8°F.], the young were produced from March to November, inclusive.

In the autumn of 1935, fish from the breeding pond were sent to several anti-malaria stations in the Department of Moscow and liberated in natural accumulations of water. Previous attempts to establish *Gambusia* in the Moscow region have shown that they thrive under natural conditions till the frosts begin, and are effective against Anopheline larvae.

[Il'inskiĭ (S.).] **Ильинский (С.). Sur l'indice cystique de l'*Anopheles maculipennis messeae* Fa., dans les environs d'Orenburg en été 1935.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 p. 129. Moscow, 1936.

Collections of adults of *Anopheles maculipennis messeae*, Flni., were made from 1st June to the middle of September, 1935, in a country resort on the river Ural that is visited by many people from the neighbouring town of Orenburg. Of the 1,411 females dissected, the percentages possessing fat-bodies and those infected with oöcysts of *Plasmodium*, respectively, were 0 and 0·46 in June, 0·6 and 1·33 in July, 49·3 and 2·45 in August, and 52 and 1·3 in the first half of September. The mean temperatures and relative humidities were 18·3°C. [64·94°F.] and 61 per cent. in June, 21°C. [69·8°F.] and 64 per cent. in July, 21·7°C. [71·06°F.] and 53 per cent. in August, and 16°C. [60·8°F.] and 63 per cent. in September.

[Polovodova (V.).] **Половодова (В.). Larves d'*Anopheles bifurcatus* (L.) constatées dans la région Tcherdyne (Oural) au 60° Lat. N.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 129–130. Moscow, 1936.

In August and September 1935 a few larvae of *Anopheles claviger*, Mg. (*bifurcatus*, auct.) were found in the north of the Department of Perm, which considerably extends the northern range of this species in the Russian Union. The larvae found in September were of the second and fourth instars and occurred in a pool formed by a forest stream in peat among roots of trees covered with moss. The water

had a temperature of 12°C. [53·6°F.] and was covered with a dense growth of *Lemna minor*. Races of *Anopheles maculipennis*, Mg., found in the district were the typical form and *A. maculipennis messeae*, Flni.

[Trofimov (G. K.).] Трофимов (Г. К.). **Constatation du *Culex tritaeniorhynchus* Giles dans le sud-est de la Transcaucasie.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 130–132, 6 figs., 3 refs. Moscow, 1936.

Descriptions are given of the adults of both sexes and larva of *Culex tritaeniorhynchus*, Giles, which was the prevalent species of the genus in August–September 1934 in the plain near Lenkoran in the south-east of Azerbaijan, but has not previously been recorded from the Russian Union. The larvae were chiefly collected from shallow accumulations of water exposed to the sun, and in rice plantations. This mosquito was not found in the mountains.

[Klemparskaya (A.).] Клемпарская (А.). **L'augmentation de la concentration des matières organiques dans les gîtes d'*Anopheles* comme mesure antilarvaire.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 132–133. Moscow, 1936.

It is known that Anopheline larvae do not develop in highly polluted water containing decaying organic matter and having a marked acid reaction, and in experiments in June–August 1935 near Saratov they were successfully controlled in stagnant water in pits, each about 3 ft. deep and forming part of an irrigation system, by throwing 1–2 spadefuls of dung into each pit. No larvae were present in any of the waters 2–3 days after the dung was introduced. Water treated with dung is of value for watering vegetable crops, whereas water that has been oiled stains and scorches the plants. Human faeces should not be used, in view of the possibility of spreading intestinal infections.

Dugdale (J. N.). **Malaria in Portugal.**—*J. trop. Med. Hyg.* **39** no. 13 pp. 149–150. London, 1st July 1936.

In the course of a visit to Portugal, the author collected information on the malaria situation and the work that is being carried out to control the disease. In the rice-growing areas, which are large, the spleen rate is 60–90 per cent. among the children. The vectors are *Anopheles maculipennis* var. *atroparvus*, van Thiel, which is the most important, and *A. claviger*, Mg. (*bifurcatus*, auct.), both of which breed in the rice-fields. The most heavily infected people are the workmen who come to the rice-fields at the time of harvest and sleep in the open. An attempt is being made by means of legislation to compel employers to construct mosquito-proof quarters for these workers. Screening has been found very effective in reducing the percentage of malaria infection. Large numbers of Anophelines were taken in a rabbit hutch in a locality nearly a mile from the nearest breeding place, where catches made in human habitations rarely amounted to more than 20 or 30. As many as 2,693 were collected at one time in one small hutch and an almost equal number escaped. No Culicines were found in the hutches. Villages are now being protected by a barrier of rabbit hutches. Paris green, which had been used extensively, was not very effective and also injured the growing rice. As the choice of

larvicides that would not injure the rice is limited, growers have been advised to practice interrupted irrigation, in which the water is diverted until the rice-fields become sufficiently dry to kill the larvae.

STRICKLAND (C.) & ROY (D. N.). **The Prevalence and Habits of Anophelines in Relation to physical Conditions (with a statistical Analysis** by H. P. CHAUDHURI).—*Riv. Malariol.* **15** Sez. 1 fasc. 3 pp. 171–197, 5 charts. Rome, 1936. (With a Summary in Italian).

In 1932 the authors found that in Calcutta the malaria infectivity of *Anopheles stephensi*, List., was highest during the cold season and lowest in the hot weather, while during the rains there was a gradual increase from zero to the cold weather condition [*R.A.E.*, B **21** 78]. As this variable seasonal infectivity did not accord with the incidence of malaria in Calcutta [*loc. cit.*], an attempt was made to ascertain from November 1932 to November 1933 some of the factors contributing to the latter, such as the prevalence and habits of the mosquito.

The 22 wards recorded as most malarious were visited monthly in rotation, hand catches of mosquitos being made in all kinds of possible habitats. Adult habits were studied in the laboratory and field.

A graph shows the relative monthly prevalence of Anophelines caught in Calcutta, the peak being in November, and a table gives the specific composition of the total catch of 8,564, of which 273 (3·24 per cent.) were *A. stephensi*. Another table gives the relative prevalence of the various species caught monthly.

The following is taken largely from the summary. The seasonal prevalence of Anophelines had a significant relationship with absolute humidity and with the rainfall 4 weeks earlier, and this relationship was very much accentuated in the case of *A. stephensi*, which may fairly be called a rains mosquito. Anophelines in general dispersed from human habitations during the daylight hours, the morning catches being 5,790 and the evening 2,874, so that the loss was 50 per cent. With *A. stephensi* the respective figures for November 1932 were 159 and 120, so that the loss was only 25 per cent. The sex ratio of *A. stephensi* was markedly different from that of the other species, the percentage of females being 62, the lowest found. This, in conjunction with the smaller loss by day, is evidence of the domesticity of the species. Larvae of *A. stephensi* in a natural breeding place developed normally into adults, so that the comparatively small numbers of adults caught during the survey cannot have been due to lack of natural viability of the larvae. Females fed on raisins and water lived about as long as those that had also a feed of blood, but those fed on blood only lived a much shorter time. There appeared to be a very marked preference in *A. stephensi* for biting a native of Bengal, and also a marked preference for a native of Nepal rather than a European. The avidity for feeding at night-time was very marked. At the same time there was very slight relationship between feeding and temperature and it rather appeared that humidity was the more important factor. Chaudhuri found that the relationship was very significant, and the authors conclude that this is an important factor concerned in the seasonal incidence of malaria, as the humidity in Calcutta is on the decline in November.

Chaudhuri's statistical analysis of the relations of the number of Anophelines caught to physical conditions (mean temperature, humidity,

saturation deficiency and rainfall) covers the period December 1932 to November 1933 inclusive.

SEPULCRI (P.) & DE NEGRI (U.). **Osservazioni sull' anofelismo nel delta del Po e zone limitrofe.** [Observations on Anophelism in the Delta of the Po and adjoining Districts.]—*Riv. Malariol.* **15** Sez. 1 fasc. 3 pp. 198–206 1 map, 1 pl., 6 refs. Rome, 1936.

In a survey of the occurrence of the varieties of *Anopheles maculipennis*, Mg., in the province of Rovigo, the authors distinguish a coastal zone where malaria is endemic and where *A. sacharovi*, Favr (*maculipennis* var. *elutus*, Edw.) is the most abundant form and an inland zone where vars. *maculipennis* (*typicus*) and *messeae*, Flni., predominate. Vars. *atroparvus*, van Thiel, and *labranchiae*, Flni., were also found in smaller numbers in both zones and *A. claviger*, Mg. (*bifurcatus* auct.), which the authors include in the list of varieties, occurred in the coastal zone and only in small numbers.

TAGLIABUE (C.) & PERILLI (R.). **Ricerche sperimentali sulle diverse razze di *Anopheles maculipennis* e sulle preferenze alimentari degli anofeli in Provincia di Milano.** [Experimental Investigations on the various Races of *A. maculipennis* and on the Food Preferences ot *Anopheles* in the Province of Milan.]—*Riv. Malariol.* **15** Sez. 1 fasc. 3 pp. 207–216, 12 refs. Rome, 1936. (With a Summary in French.)

In the province of Milan Anophelines are abundant but there is little malaria (5–10 per cent.). *Anopheles maculipennis*, Mg., is the predominant species. After a brief note on the various races of this mosquito [*R.A.E.*, B **21** 177, etc.], the author records the results of his investigations on those occurring in the province. *A. maculipennis* var. *messeae*, Flni., which is generally considered to be zoophilous, predominated in the malarial zones (70 per cent.) and in those without malaria (92 per cent.). Var. *labranchiae*, Flni., which is usually regarded as anthropophilous, was fairly common (19 per cent.) in the malarial zones and was very rare (0·3 per cent.) in the non-malarial ones. Var. *maculipennis* (*basilei*, Flni.) was not common (9·9 per cent.) in the malarial zones and even less (7·7 per cent.) elsewhere. It was found that in the malarial zones 39 per cent. of the mosquitos had fed on man in dwellings having a cow-shed or pig-sty between them and the breeding centre, while 56 per cent. had done so in dwellings not thus protected. In the non-malarial zones the respective percentages were 20 and 44. In cow-sheds in both zones practically all the mosquitos had fed on cattle.

The predominance of *messeae* and the action of zooprophylaxis may explain the decrease of malaria in the province in recent years, despite the large numbers of Anophelines that occur there.

KLIGLER (I. J.) & MER (G.). ***Anopheles* in Syria and their Distribution.**—*Riv. Malariol.* **15** Sez. 1 fasc. 3 pp. 217–221. Rome, 1936. (With a Summary in Italian.)

This paper records the results of an Anopheline survey made in Syria in October 1935, the chief object being to study the distribution of *Anopheles sacharovi*, Favr (*elutus*, Edw.) and to ascertain if any ot the varieties of *A. maculipennis*, Mg., occur. *A. sacharovi* was the only representative of the *maculipennis* group found. Its breeding places

resembled those characteristic for it in Palestine, and larvae of *A. hyrcanus*, Pall., also occurred in them. In addition, *A. sergenti*, Theo., and *A. superpictus*, Grassi, were found in flowing streams in various parts of the country and as far north as Alexandretta.

Papers noticed by Title only.

Jobling (B.). **Morphological Differences, in the Larval Stages, between Autogenous and Anautogenous Races of** *Culex pipiens*.—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 1 p. 4. London, 30th June 1936.

Bali (B.). **Etude sur les nervures transversales dans les ailes d'***Anopheles maculipennis* **de l'Asie Mineure.**—*Bull. Soc. Path. exot.* **29** no. 5 pp. 518–521, 4 figs., 1 ref. Paris, 1936.

[Bogoyavlenskiĭ (N. A.).] **Богоявленский (Н. А.). Existence simultanée des** *Gambusia* **et des larves d'anophèles dans les eaux à végétation limnique abondante.** [*In Russian.*]—*Med. Parasitol.* **5** no. 1 pp. 62–65. Moscow, 1936. [*Cf. R.A.E.*, B **24** 140.]

Gil Collado (J.). **Distribución de los insectos hematófagos en España.** [The Distribution in Spain of Blood-sucking Insects (recorded from man).]—*Primer Congr. nac. Sanidad 1934, Actas* **4** pp. 96–106. Madrid, 1935. [Recd. July 1936.]

Nájera Angulo (L.). **Un caso de otomiasis por** *Wohlfahrtia magnifica* [in Spain].—*Primer Congr. nac. Sanidad 1934, Actas* **4** pp. 293–299, 4 figs. Madrid, 1935. [Recd. July 1936.] [See *R.A.E.*, B **24** 3.]

Wagner (J.). **A new Flea,** *Ctenocephalides paradoxuri*, **sp. n.** [on *Paradoxurus zeylanicus*], **from Ceylon.**—*Ann. Mag. nat. Hist.* (10) **18** no. 103 pp. 66–67., 2 figs. London, July 1936.

Ewing (H. E.). **The Taxonomy of the Mallophagan Family Trichodectidae, with special Reference to the New World Fauna.**—*J. Parasit.* **22** no. 3 pp. 233–246, 2 figs., 9 refs. Baltimore, Md, June 1936.

Ward (J. W.). **Boopinae Mallophaga** [*Heterodoxus longitarsus*, Piaget] **collected from Oklahoma City Dogs.**—*Proc. Oklahoma Acad. Sci.* **14** pp. 22–23, 2 figs. Stillwater, Okla., 1934. [Recd. May 1936.]

Frick (G.). **Das Zeichnungsmuster der Ixodiden. Versuch der Analyse einer Tierzeichnung.** [The Pattern of the Marking in the Ixodids. An Attempt to analyse an Animal Marking.]—*Z. Morph. Oekol. Tiere* **31** no. 3 pp. 411–430, 21 figs., 7 refs. Berlin, 9th June 1936.

Schulze (P.). **Das Schmelzmuster des Scutums von** *Amblyomma*, **ein kleiner Nachtrag zu der Arbeit von G. Frick : Ueber das Zeichnungsmuster der Ixodiden.** [The Diffused Pattern of the Scutum in *Amblyomma*, a brief Supplement to G. Frick's Work : On the Pattern of the Marking in the Ixodids.]—*Z. Morph. Oekol. Tiere* **31** no. 3 pp. 431–432, 2 figs. Berlin, 9th June 1936.

Wardle (R.). **General Entomology.**—Demy 8vo, vii+311 pp., 96 figs. Philadelphia Pa., P. Blakiston's Son & Co., 1936. Price $2·25. [See *R.A.E.*, A **24** 564.]

STRICKLAND (C.) & ROY (D. N.). **Abstract of a Paper on Experimental Malarial Infection of** *A. subpictus* **Grassi** (*A. rossi* **" type " Giles).**—*Indian med. Gaz.* **71** no. 6 p. 327, 4 refs. Calcutta, June 1936.

The authors point out that almost at the same time as their paper suggesting that the forms of *Anopheles subpictus*, Grassi, existing in India and the Netherlands Indies might belong to different races [*R.A.E.*, B **24** 127], there appeared a paper by Walch and Walch-Sordrager [**24** 16; *cf.* also **24** 127] in which the eggs of *A. subpictus* from Java were shown to differ from those of *A. subpictus* as described by Christophers and Barraud in their work on the eggs of Indian Anophelines [**19** 167].

YACOB (M.). **A Note on the Use of Cyanogas " A " Dust as a Raticide and Pulicide.**—*Indian med. Gaz.* **71** no. 6 pp. 336–338, 1 diagr. Calcutta, June 1936.

The author describes experiments to test the value of calcium cyanide in the form of Cyanogas " A " dust for the destruction of rats and their fleas in the control of plague in the Punjab. Rats were placed at distances of 5, 10, 15 and 20 ft. from the entrance of an artificially constructed horizontal rat-hole and at the end of a hole $4\frac{1}{2}$ ft. long at right angles to the main hole 10 ft. from the entrance. Varying dosages were given by increasing the number of strokes on the Cyanogas pumps used, and different intervals were allowed to elapse before the hole was dug open. It was found that with the large pump the number of strokes beyond 15 does not correspondingly increase the lethal range of the gas, which extends only to 15 ft., and that no apparent difference is made by increasing the time of exposure beyond 2 minutes. The experiments were then repeated using muslin bags containing rat-fleas in the same position as the rats. The results were almost the same as those obtained with rats. The fleas were killed in 2 minutes up to a maximum distance of 15 feet. Experiments undertaken in natural rat holes in houses under rural conditions gave equally satisfactory results.

The method extensively used at present for the control for rats and fleas in plague-infested villages in the Punjab is fumigation by means of small bundles of cloth, each provided with a wick and each containing 2 drachms potassium chlorate, 2 drachms sulphur, $1\frac{1}{2}$ drachms potassium nitrate, 1 drachm red pepper and 4 drachms mustard oil mixed with waste paper and broken straw and husks from threshing floors. Previous experiments have shown that the lethal range of the smoke from these bundles is not greater than 10 ft. for rats and 5 ft. for rat-fleas. About one-eighth of the bundles become extinguished after the rat-holes are closed with mud and consequently fail to destroy the rats. On an average one rat-hole does not require more than 1 oz. Cyanogas " A " dust, which costs about three times as much as a single bundle. With dusting there is the initial outlay for pumps and the additional expense of repairs; moreover, the Cyanogas is dangerous to man unless care is exercised in its application. With the older method, the work of plague gangs can be checked from the charred remains of the bundles. Details are given of the staff and equipment required for dusting, the method to be used and the precautions to be taken.

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Frost (F. M.), Herms (W. B.) & Hoskins (W. M.). **The Nutritional Requirements of the Larva of the Mosquito,** *Theobaldia incidens* **(Thom.).**—*J. exp. Zool.* **73** no. 3 pp. 461–479, 32 refs. Philadelphia, Pa, 5th July 1936.

This study was undertaken to investigate the possibility of rearing mosquitos to the adult stage on a diet of known composition and in surroundings relatively free from bacteria, and the most favourable concentration of food and the favourable range of pH. *Theobaldia incidens*, Thoms., was selected, since it breeds in pools and artificial containers throughout the San Francisco Bay region and its eggs can be readily obtained in March–October. The following is taken from the authors' conclusions. Baker's yeast proved an adequate diet, the most favourable concentration being 2–2·5 mg. per cc. The tolerated pH range was from less than 5 to at least 8. Dried brewer's yeast was an adequate diet at a concentration of 1 mg. per cc. Technical and purified caseins were inadequate, but were improved by the addition of certain inorganic salts. Vitamin-free casein supplemented with dried yeast was a good diet. Proteins are by far the most important class of foodstuffs, and carbohydrates and fats are required, if at all, in very small amounts. Vitamins A, B, C, D and E did not appear to be needed.

Keeping the larvae in complete darkness was unfavourable to survival. Ultra-violet light given in small daily doses hastened development, but larger amounts were harmful. The bearing of the feeding habits of larvae on the interpretation of tests for essential foodstuffs is discussed.

Lutz (A.). **Entstehung, Ausbreitung und Bekämpfung der Lepra.** [Origin, Distribution and Control of Leprosy.]—*Ann. Acad. bras. Sci.* **8** no. 2 pp. 87–125, 40 refs. Rio de Janeiro, 1936.

The author discusses existing knowledge regarding leprosy, including suggestions that it can be transmitted by mosquitos [*cf. R.A.E.*, B **12** 54, etc.], and considers that such transmission is the only plausible explanation of the fact that it spreads quickly in some localities and does not do so in others. The segregation of patients without protection against mosquitos is therefore useless.

Russell (P. F.) & Baisas (F. E.). **A Practical Illustrated Key to Adults of Philippine** *Anopheles*.—*Philipp. J. Sci.* **59** no. 1 pp. 15–64, 34 pls. (7 col.), 6 figs., 19 refs. Manila, January 1936. [Recd. July 1936.]

Baisas (F. E.). **Notes on Philippines Mosquitos, IV. The Pupal and certain Adult Characters of some rare Species of** *Anopheles*.—*T.c.* pp. 65–84, 15 pls., 1 fig., 29 refs.

The paper on the identification of adults of the Philippine Anophelines consists of a list of 28 species or varieties, brief descriptive notes on each, a dichotomous key and numerous original illustrations. The classification and synonymy of these Anophelines has been dealt with in the larval key already noticed [*cf. R.A.E.*, B **23** 196] ; three are unnamed [but of these one is described in the second paper and another is *Anopheles cristatus*, King & Baisas (**24** 223)].

In the second paper the author discusses the Anophelines of the group of *Anopheles leucosphyrus*, Dön. ; he restricts the name *A. leucosphyrus* to the type represented in Luzon and gives the name var.

balabacensis to the form found in Palawan and Balabac, which was one of the unnamed varieties mentioned in the keys to the larvae and adults [*cf.* preceding paper]. He also gives the name *A. gateri*, sp. n., to the species provisionally designated in these same papers as *A. baezai*, Gater (?). A table is given showing the pupal characters of this species, *A. gigas* var. *formosus*, Ludl., *A. lindesayi* var. *beguetensis*, King, and *A. karwari*, James.

ROBERTSON (R. C.) & HU (S. M. K.). **The Tiger Mosquito in Shanghai.** —*China J.* **23** no. 5 pp. 299–306, 1 pl. Shanghai, 5th November 1935. [Recd. August 1936.]

Aëdes albopictus, Skuse, is a troublesome pest in Shanghai, its bites being unnoticed at the time but giving rise subsequently to considerable irritation. The eggs are laid singly, usually in discarded tins or similar receptacles. The larvae require very little nourishment and develop readily in containers for storing drinking water, feeding on microscopic bacteria.

KEIR (W.). **Note on Mosquito Larva from Tay Basin.**—*Trans. Perthshire Soc. nat. Sci.* **9** (1933–35), no. 5 p. 147. Perth, 1936. **A Survey of the Breeding Places of the Mosquitoes of Downfield District, Dundee.**—*T.c.* pp. 148–150.

These papers record the rearing of *Anopheles claviger*, Mg. (*bifurcatus*, auct.) and *Theobaldia annulata*, Schr., from larvae and pupae taken near Dundee.

SAUTET (J.). **Contribution à l'étude des Culicidae et en particulier de ceux jouant un rôle important dans la transmission du paludisme.**—*Rev. Méd. Hyg. trop.* **28** nos. 2–3 pp. 65–96, 129–160, 6 figs. Paris, 1936.

The first two sections of this paper, which is based on material from Corsica, include descriptions of the bucco-pharyngeal armature and digestive tract of the larvae of various species of mosquitos, particularly *Theobaldia annulata*, Schr., *Anopheles maculipennis*, Mg., and *A. claviger*, Mg. (*bifurcatus*, auct.). No differences of value for distinguishing the races of *A. maculipennis* studied from one another or from *A. sacharovi*, Favr, were observed. In the third section the anal papillae of fourth instar larvae are described and in the fourth their function is discussed, together with experiments which indicate that they play only an incidental part in respiration [*cf. R.A.E.*, B **21** 74]. The last section is concerned with the effect of various factors, particularly cold, on the development of eggs, larvae and pupae. Observations on eggs laid in the laboratory by reactivated hibernating females showed that there is no difference in the behaviour of those of *A. sacharovi* and of various forms of *A. maculipennis*, all of them being killed when exposed for an average of three months to a temperature of 4°C. [39·2°F.], although eggs from the same batches kept at laboratory temperatures gave rise to larvae in 5–7 days. In similar experiments carried out during the summer with the eggs of active females, those kept at laboratory temperatures, which were higher at this time, hatched in an average of 48 hours and those kept at 4°C. hatched in an average of 18–20 days, although in the case of *A. sacharovi* about 30 per cent. died. It is suggested that the eggs of reactivated females have

less vitality than those laid in summer; it has been observed that over-wintering females lay fewer eggs. It is also possible that the heat used to bring about oviposition that would not take place in nature may induce the deposition of eggs less resistant to unfavourable external conditions. The findings of other authors on this subject are discussed. It would appear that, at least so far as Anophelines are concerned, the development of eggs depends not only on temperature but on the state of the ovipositing female. Experiments showed that the addition of oxidising agents, sodium chloride (7 and 20 per cent.) or *Ceratophyllum*, to the water containing eggs of *A. maculipennis* var. *labranchiae*, Flni., or *A. sacharovi*, whether laid by reactivated or normal females, had no effect on hatching. Eggs of these two Anophelines kept in damp heat without water survived for an average of 3 days in winter and 2 in summer. These findings do not indicate the existence in these species of durable winter eggs [*cf.* **18** 35] that remain on the mud and do not hatch until the spring floods. On the other hand, it was observed that the eggs showed a tendency to move by capillarity up the sides of the jars or the vertical stems of plants, so that if the water lost through continuous evaporation were not replaced the eggs dried up and a high mortality ensued; if, however, they were submerged again in two or three days time, they generally hatched. This may partly account for the appearance of Anophelines at the time of summer rains in numbers out of proportion to the extent of the breeding place. Experiments showed that the effect of prolonged exposure to cold on the larvae and pupae of *A. maculipennis*, *A. sacharovi*, *T. annulata* and *Culex pipiens*, L., all collected from the eastern plain of Corsica, was similar in all species. At 4°C. the larvae succumb rapidly if in the first instar, but become progressively more resistant in the second, third and fourth instars; the pupal stage is more resistant still. It is known that adults can be kept for months at this temperature and afterwards return to normal activity. When pupae kept at 4°C. for 10–15 days were placed at 16–18°C. [60·8–64·4°F.] about 50 per cent. gave rise to adults, and a similar result was obtained with *T. annulata* kept for 38 days, in spite of the fact that none of these species hibernates in the pupal stage.

WEYER (F.). **Zur Kenntnis der Rassen von** *Anopheles maculipennis* **im Schwarzwaldgebiet.** [Contribution to a Knowledge of the Races of *A. maculipennis* in the Black Forest District.]—*Jh. Ver. vaterl. Naturk. Württemb.* **91** pp. 157–163, 7 refs. Stuttgart, 1935. [Recd. July 1936.]

This paper records the local distribution and abundance of *Anopheles claviger*, Mg. (*bifurcatus*, auct.), and of *A. maculipennis*, Mg., vars. *maculipennis* (*typicus*), *atroparvus*, van Thiel, and *messeae*, Flni., as observed, almost exclusively in June–July 1933, in the Black Forest district.

VOLLMER (O.). **Ueber** *Anopheles maculipennis*-**Dauerzucht und einige Zuchtversuche.** [On the continuous Rearing of *A. maculipennis* and some Experiments in Rearing.]—*Arch. Schiffs- u. Tropenhyg.* **40** no. 8 pp. 342–352, 1 fig. Leipzig, August 1936.

A description is given of the method used at the Provincial Hospital at Düsseldorf-Grafenberg, Germany, for rearing abundant supplies of *Anopheles maculipennis*, Mg., for the treatment of paralysis by means of induced malaria. The two main cages for the adults are fairly large

(36×20×24 inches) in order to ensure mating flights and are covered with mosquito net, as wire gauze injures the wings. Begun in November 1933, the work has developed in 2½ years into a large scale breeding of *A. maculipennis* var. *atroparvus*, van Thiel, which has proved a good vector of malaria and ideal for rearing. Work with var. *messeae*, Flni., was begun at the same time, but it did not breed readily, and died out in March. A new strain of this race was obtained in May, but in June it proved to be contaminated, for eggs of *atroparvus* appeared, and from the end of July onwards only *atroparvus* eggs were obtained. Attempts to breed *A. sacharovi*, Favr (*elutus*, Edw.) were unsuccessful, owing to insufficient space for the mating flight. *A. claviger*, Mg. (*bifurcatus*, auct.) also could not be reared, but the reason is unknown.

The insectary operations for rearing *atroparvus* are described. The adults were fed on a small pig or, occasionally, on a rabbit. If the host was in ill health fewer mosquitos fed on it, but apparently the odour of an ailing animal was no deterrent if they were hungry. The size of the adults depended on larval nutrition. The average wing-length was 4·996 mm. and the maximum 5·9. Rain-water was provided for oviposition and the egg-masses were put in sterilised earthenware dishes in which a fresh grass sod had been placed with rain-water up to the grass surface. Decomposition occurred gradually, and for successful rearing it was necessary for the larvae to be numerous enough to keep the water clear of a surface film by their feeding [*cf.* next paper]. The usual situation of the larvae was between the grass blades, probably because oxygen is given out by the living grass and also because the flora and fauna that serve as food develop there. The pupae were regularly transferred to clean rain-water renewed daily, disks of cork being provided as rafts for the newly emerged adults. To avoid degeneration by inbreeding about 100 adults, captured in stables and cellars, were added once a year.

It appears as if some changes have occurred during the 2½ years. Many males and many ovipositions now occur in winter and the females more readily feed on blood as early as January, from 80 to 90 per cent. being noticed on the pig. It would seem that the females of *atroparvus* prefer the blood of pig and those of *messeae* that of man, on which they fed readily from the start of the work. When both races were fed on the same host, *messeae* throve better on man, and *atroparvus* much better on pig.

Roubaud (E.). **Le nettoiement des surfaces d'eau par les larves d'anophèles.**—*Bull. Soc. Path. exot.* **29** no. 6 pp. 688–691, 2 figs. Paris, 1936.

Anopheline larvae living at the surface of water continually stir the upper layer of liquid while feeding on floating microscopic particles, and must in this way exercise a destructive action on surface films and impurities in stagnant waters. That this is so has been observed when rearing larvae of *Anopheles maculipennis*, Mg., in large jars containing tufts of growing grass, under conditions simulating those found in flooded meadows. When the larvae are actively feeding, the surface of the water becomes perfectly clear, whereas when pupation has taken place, it immediately becomes covered with a thick, continuous film of microscopic animal and vegetable organisms. On the addition of a sufficient number of young active larvae such films again disappear. Thus, although it is usual to state that the development of larvae

generally takes place in clear water, it is necessary to point out that the clearance is largely due to the presence of the larvae. It is suggested that the cleaning action of the larvae may have a favourable effect on the plants, since the removal of the film may aid the exchange of gases necessary for the life of the submerged parts.

ROUBAUD (E.) & COLAS-BELCOUR (J.). **Observations biologiques sur les glossines** (*Gl. palpalis, Gl. morsitans*).—*Bull. Soc. Path. exot.* **29** no. 6 pp. 691–696, 2 figs., 3 refs. Paris, 1936.

In January 1936, several thousand pupae of *Glossina palpalis*, R.-D., were brought by aeroplane from Uganda and kept in Paris in an incubator at a relative humidity of about 70 per cent. and temperature averaging 25–28°C. [77–82·4°F.] during the day but sometimes exceeding 32°C. [89·6°F.] during the night. Almost two-thirds of the pupae died without giving rise to adults, a large number produced flies that did not develop, and only about 250 normal adults were obtained, of which less than 10 per cent. were females. From an examination of the sex proportions among those that died and among those that survived, it is concluded that in the pupal stage females are much less resistant to unfavourable conditions than males. This fact was also observed in the course of rearing *G. morsitans*, Westw., for after three years the strain became extinct through spanogyny or lack of females, the last pupae giving rise to males only. It is suggested that the lack of resistance of the females may account in part for the presence of males alone or in predominant numbers in certain natural haunts of the fly. The few surviving females of *G. palpalis* fed and paired and some lived for 6–7 weeks, but none deposited larvae, although normal ones usually do so about 3 weeks after emergence.

At intervals between 5 and 8 weeks after emergence, the 11 remaining females were dissected; none contained larvae, 4 contained mature but unhatched eggs in the uterus and 7 contained mature eggs still in the ovaries. It is thought that the absence of larval development was due to the non-fertilisation of the ovules due to an abnormality in the generative organs of the females. Examination of the three last females showed that the spermathecae were void of spermatozoa although numerous pairings had been observed and the testicles of the males contained spermatozoa. A similar observation was also made in 1935 on *G. morsitans* from Tanganyika. Rearing was successfully carried out during the early part of the year when the temperature in the incubator was 25–28°C. and the relative humidity 55–60 per cent., but between May and July, when the temperature rose to 30–35°C. [86–95°F.] and the humidity fell to 50 per cent., the production of larvae ceased completely and dissection of the last two females showed mature unhatched eggs in the uterus and an absence of spermatozoa in the spermathecae. Possibly the spermatozoa are destroyed in the genital ducts of the female before they reach the spermathecae.

The Eulophid, *Syntomosphyrum glossinae*, Wtstn., was obtained from two or three of the pupae from Uganda, and was reared through one generation on pupae of the house-fly [*Musca domestica*, L.]. The females also pierced with their ovipositors a pupa of *Galleria mellonella*, L., which died, but no parasites developed. The variations in temperature and humidity that had adversely affected the breeding of *Glossina* also affected the parasites, the greater part of the second generation dying within the host pupae.

Lloyd (Ll.). **Assessment of a Tsetse Population.**—*Bull. ent. Res.* **27** pt. 2 pp. 261–267, 1 fig., 5 refs. London, July 1936.

The following is largely the author's summary: An experiment carried out in Nigeria from October 1928 to February 1929 is described, in which adults of *Glossina tachinoides*, Westw., in an isolated secondary focus were marked with distinct colours during 13 successive weeks and the fate of the groups studied by recaptures. The population was known to be declining from moderate density to great scarcity through the dry season, and the wastage in the colour groups on the average proved to be 11½ per cent. per day, rather more, probably, than the wastage in unmarked flies. By Jackson's method of assessment [*R.A.E.*, B **22** 12], the population is shown to fall from 6,000 at the end of October to 400 by mid-January. The ratio of the boy-hour rate to these numbers is worked out for each collection, and it is found that when the boy-hour rate is above 50 it is not relative to population, but below 50 the rate falls as the population, allowing for the influence of weather on rate of catching. It is shown that, under the conditions of the experiment, there is an almost complete change of fly population each 5 or 6 weeks, though an occasional fly may survive 11 weeks. The proportion of male flies in the catches fell with increasing age from an initial 57 per cent. to 23 per cent. in the 6th week, and no male fly surviving this period was caught.

Nash (T. A. M.). **The Relationship between the Maximum Temperature and the Seasonal Longevity of** *Glossina submorsitans*, **Newst., and** *G. tachinoides*, **Westw., in Northern Nigeria.**—*Bull. ent. Res.* **27** pt. 2 pp. 273–279, 2 figs., 8 refs. London, July 1936.

In continuation of previous work on *Glossina morsitans submorsitans*, Newst., and *G. tachinoides*, Westw., in Northern Nigeria [*R.A.E.*, B **23** 142], two experiments were carried out to elucidate the seasonal fluctuations in their longevity. In the first, at the beginning of every month during 1½ years (1934–35), 105 freshly emerged flies of each species were placed in cages in a grass hut, which protected them from the sun and rain but not from wind. The climate closely resembled that found in a small, dense thicket in open woodland, a site that forms a temporary fly habitat in the cooler months but is evacuated from March until May, when the heat is excessive, in favour of the cooler and more extensive patches of heavy residual forest. The average lengths of the lives of males and females for each batch of both species over a period of one year are plotted on a graph against the month in which the middle day of their lives occurred; maximum temperatures and rainfall are also given. To obviate the criticisms that caged flies may react differently to wild flies, and that during the hottest season the caged flies were not able to migrate to the residual forest, so that the decreased longevity observed may not occur in nature, a second experiment was undertaken in which flies of both species were caught in the forest four times a month, marked on the thorax with oil paints, and liberated. Some were eventually retaken and their age noted. To obtain an index of longevity it was assumed that the last fly of a batch to be recaptured was approaching death and that it had been one of the youngest at the time of marking; thus the day of marking was taken as the day of its emergence and the day of recapture as the day of its death, so that the intervening period was a conservative estimate of the maximum

longevity for that season. In 13 months 4·4 per cent. of *G. morsitans submorsitans* and 5·8 of *G. tachinoides* were recaptured. Owing to their reluctance to attack man, the females of the former, and to a less extent those of the latter, could not be marked in sufficient numbers to be of value, so that the figures given are based on males only. They are compared with those for maximum longevity among males in the first experiment. It would appear that the flies live longer under artificial conditions, but this may be an illusion, because only a conservative estimate of longevity in the open could be obtained. Every maximal and minimal point on the curve for the open is about a month later than on that for the grass house, probably because the flies in the grass house are immediately affected by a rise in temperature, whereas wild flies can take refuge first in the residual forest and then on the forest floor, where the lowest temperatures are recorded, so that they would not be affected until later. It is considered that the marking experiment, despite the defects of its technique, confirms the conclusions founded on the grass house experiment.

The following is taken from the author's summary: There are considerable variations in the longevity of both species of flies, and these variations are negatively correlated with fluctuations in the maximum temperature. Longevity increases when the rains begin and temperature falls, and remains high throughout the rains. When the wet season ends, temperature rises and longevity decreases. Longevity reaches its maximum during the cold weather, but decreases to its minimum when the temperature rises again, and remains low until the rains begin. Maximum temperature is considered to be the dominant determining factor; favourable humidity cannot increase longevity unless the maximum temperature is favourable. The oldest individuals occur in the rains, but the average longevity is highest in the cold season, when both temperature and humidity are favourable. In both species the females tend to live longer than the males, and in the field the males of *G. tachinoides* appear to live rather longer than those of *G. morsitans*. It is doubtful whether wild flies of either species live much more than 2½–3 months under the most favourable conditions; it is probable that in the hottest weather this period is reduced to a month or less, and that the production of puparia is seriously affected when the rains are late and the hot weather is prolonged.

Buxton (P. A.). **Studies on Soils in Relation to the Biology of** *Glossina submorsitans* **and** *tachinoides* **in the North of Nigeria. With an Appendix by K. Mellanby.**—*Bull. ent. Res.* **27** pt. 2 pp. 281–287, 1 fig., 3 refs. London, July 1936.

The following is the author's summary: It is known that there is a high mortality in puparia of *Glossina morsitans submorsitans*, Newst., and *G. tachinoides*, Westw., if they are kept in air that is far from saturation; it seems anomalous that there is no evidence of mortality among puparia in nature at the end of the dry season when the soil in the thickets appears to be quite dry [*cf. R.A.E.*, B **23** 63]. Experiments are described, showing that the soil of the thickets (unlike the more sandy soil of the open country) will take up large quantities of water; as its colloid content is high, this soil must also possess great power of retaining the water. Moreover even when the soil seems quite dry (water content 4 per cent.) the atmosphere in the soil spaces is very nearly saturated. It appears, therefore, but it is not proved, that the

soil atmosphere in the north of Nigeria even under extreme conditions of heat and drought may not be so dry as to be unfavourable to the puparia of these two species of flies.

In the appendix K. Mellanby describes a method of measuring the humidity of the soil atmosphere.

MURRAY (D. R. P.). **Mineral Oils as Mosquito Larvicides.**—*Bull. ent. Res.* **27** pt. 2 pp. 289–305, 9 refs. London, July 1936.

The physical and chemical properties that make an oil suitable for use as a mosquito larvicide are very imperfectly understood. It is known that oil penetrates the tracheal system of the larvae [*cf. R.A.E.*, B **6** 183; **15** 68; **17** 243], and the aim of the experiments here described has been to determine whether the presence of oil in the tracheae is invariably fatal to larvae, and, if so, whether the presence of an oil film covering the whole of the water surface invariably leads to the penetration of the oil into the tracheae of all the larvae under it.

The experiments were carried out on reared larvae of *Aëdes aegypti*, L., *Anopheles maculipennis*, Mg., and *Culex fatigans*, Wied., which last proved the most useful material because the tracheae stand out very clearly and it is easily possible to discover whether there is oil in them by examining living larvae under binoculars with a magnification of 30 diameters, even when the oil is colourless.

With regard to the first question no larva of which the tracheae were filled with oil was found to pupate, although large numbers were observed. The time of survival, however, varied greatly, and larvae containing oil of poor toxicity kept at temperatures of about 12–16°C. [53·6–60·8°F.] may live for several weeks, although even if placed in their normal nutrient medium they do not develop further.

The answer to the second question is in the negative, but it was found possible to classify the conditions under which an oil will or will not penetrate. Behaviour differs with the nature of the oil and very markedly with the age of the film. At room temperature (15–23°C. [59–73·4°F.]) penetration was most rapid with oils of a boiling range of approximately 200–300°C., although some higher-boiling fractions were as efficient provided that they were not viscous. In experiments in which the larvae were exposed for only 10 minutes to the film of oil, it was exceptional to find one containing no oil and equally exceptional to find one in which oil had penetrated along the whole length of the tracheae. When these larvae were examined after being washed and left in clean water for an hour or so, oil was found throughout the length of the vessels, proving that it is capable of creeping along; the remaining air was displaced, the cubic contents of the vessels being presumably lessened by partial collapse of the walls. The larvae died in due course. In other experiments, in which the time of exposure was unlimited, the larvae behaved in three different ways, and an attempt was made to correlate their behaviour with the physical or chemical properties of the oil. When they all fell to the botton after a few contacts and remained there, the oils used were the most toxic ones, such as aromatic concentrates obtained by extraction with liquid sulphur dioxide. When they all became entangled in the surface and remained there, the oils had a high paraffin content; paraffins are not very toxic and larvae live lying in the surface for long periods. This property of paraffins appears, however, to be physical rather than related to their non-toxicity, for larvae were equally caught in the

surface with some very toxic oils with a content half paraffin and half aromatic substances. When they behaved as if normal and unaffected in spite of the oil in them, the most characteristic oil used was one of those that penetrated rapidly (although its boiling range was higher than in those already mentioned). Larvae full of oil hung in the resting position with their spiracles attached to the surface and re-attached themselves in the same way after swimming round.

The very wide divergences in times of survival are due in some cases to the amount of oil taken in. Larvae that do not rise to the film more than once or twice may obtain very varying doses of oil. The number of contacts is usually smaller with increased toxicity, but a very small quantity is sufficient to oil the whole length of the tracheae. With oils that cause the majority of the larvae to lie on the surface, it was found that in the minority on the bottom the tracheae were nearly all collapsed, whereas in those on the surface they were fully distended with oil. Those with collapsed tracheae survived longer, probably because they received a smaller dose of the toxic constituent. Difference in dose also causes the irregular results obtained with very thin films. In experiments with very thin films, the average time of survival of the larvae after oil had penetrated the tracheae was longer than normal for the oil used, but none succeeded in pupating. This suggested that they had received only a very small dose of oil, a view that was supported by the observation that the tracheae had not entirely lost their opacity but appeared mottled. It is pointed out that the limit of range of quick-penetrating oils is dependent on temperature, and that oils that failed to penetrate the tracheae regularly in these experiments will undoubtly prove adequate in warmer climates.

Experiments with oils of a boiling range below 200°C. and an exposure of 10 minutes showed that a large number of the larvae do not become "oiled." The "oiled" ones die rapidly but the tracheae of all the others were seen to be collapsed ; after a few hours some of them were dead in the same state, but others had re-distended their tracheae with air and appeared normal. Some in fact pupated, although several of these ultimately died. It is thought that the collapse of the tracheae prevents their becoming oiled in the short time allowed. With non-toxic oils, the direct movement of oil up the tracheae without any collapse may be observed, so that collapse cannot be due merely to contact of liquid with the tracheal walls ; it is more probably caused through some irritating effect of the vapour.

From experiments in which larvae and pupae were exposed to the vapour of oils it is concluded that the effect is not invariably fatal. This finding suggests that an oil that penetrates easily will produce certain results, whereas an oil that penetrates with difficulty will produce uncertain results, no matter how powerful its vapour may be.

The relation of toxicity to chemical composition was studied in refined paraffins, in refined paraffins with the addition of traces of sulphur compounds, nitrogen compounds, or hydroxy- and carboxy-compounds, and in mixtures of paraffins with hydrocarbons of the aromatic series. No distinction was made between paraffins and naphthenes, as they are equally inert towards larvae. The feeble killing power of the first group was confirmed. It is probable that they have no actual toxic effect, but kill merely by preventing access to air. Tests with the second group showed that of the chief types of non-hydrocarbons, in concentrations such as occur naturally in petroleum, only phenol is likely to add to the toxicity. As toxicity certainly

persists after the removal of phenols, the hydrocarbons themselves must be toxic. Aromatic hydrocarbons without exception are highly toxic to larvae, which survive only a short time if the hydrocarbon has penetrated the tracheae. The wide differences in volatility make difficult a comparison of the relative toxicity of different hydrocarbons in the undiluted state, but certain conclusions can be drawn from mixtures of aromatic hydrocarbons and kerosene. The most volatile aromatic compounds did not form the most toxic mixtures with kerosene. Moreover, it was found that a toxic material can be diluted with non-toxic kerosene without diminishing its activity, so that it is evidently not necessary to effect a concentration of the aromatic constituents in order to obtain an oil of good toxicity. Actually it is desirable to leave a certain percentage of kerosene in the oil, for a high percentage of non-volatile aromatics raises the density to near, or above, that of water. Moreover, the kerosene increases the stability of the film and also its ability to act on pupae.

Comparative experiments with larvae and pupae and films of a number of oils gave very variable results. Most of the work was carried out with pupae of *Culex*. Those of *Anopheles* are much more susceptible to the action of oil and die more readily, probably because their trumpets present a much larger opening through which the oil may enter. No oil used failed to penetrate and kill Anopheline pupae; they were "oiled" and killed in a short time by films under which pupae of *Culex* had remained unaffected for hours. Contact with a film of volatile substance usually deprives pupae of their power of balance and kills them, but with some oils they can survive under circumstances in which larvae are "oiled" with fatal results. The contrast between the results in these two types of experiments is very marked and helps to explain the contradictory statements in the literature.

Experiments with films of different ages showed that the penetrating power of the oil usually deteriorates with the age of the film. In thicker films the deterioration is less rapid. The cause of the failure of oil to penetrate after long exposure is not known, but in some tests it was not due to evaporation of volatile fractions, to the absorption of mineral salts at the interface of the oil and water, or to oxidation or oxidative polymerisation. From these experiments it appears that it is not altogether desirable to obtain a film of high durability. Even though adults rarely succeed in emerging successfully, if larvae are developing under the film it would be preferable to have the surface covered with fresh oil.

Thus it appears desirable to obtain an oil that readily penetrates the tracheae of the larvae, actual toxicity being of secondary importance. The oils that penetrate best are those of medium boiling range (with suitable modification for temperature), not involatile enough to be markedly viscous and not volatile enough to produce the immediately irritating effect that causes the tracheae to collapse and the larva to dive without receiving a dose of oil.

KUMM (H. W.). **The Jamaican Species of *Hippelates* and *Oscinella* (Diptera, Chloropidae).**—*Bull. ent. Res.* **27** pt. 2 pp. 307–329, 1 pl., 6 figs., 16 refs. London, July 1936.

In the course of a study undertaken in Jamaica to determine the possible importance of insects as vectors of yaws [*cf. R.A.E.*, B **24** 219, etc.],

observations were made on the morphology, distribution and habits of flies belonging to the genera *Hippelates* and *Oscinella* because they were the most abundant among insects feeding on ulcers. During a period of about 20 months, 186,084 Chloropid flies were taken, comprising 15 species; 93·7 per cent. were caught at ulcers on man or living animals and 6·3 per cent. in traps baited with decaying animal matter.

The following is taken from the author's summary: *Hippelates pallipes*, Lw., was found in greater numbers and in more localities than any other species. *H. peruanus*, Becker, was readily attracted to traps baited with animal matter, whereas *H. pallipes* came rarely to such traps. The latter was most prevalent at elevations ranging from 100 to 1,500 feet above sea leavel, *H. currani*, Aldr., was frequent at somewhat lower altitudes, and *H. pusio*, Lw., and *H. illicis*, Curran, were most common close to the sea. A key with explanatory diagrams for identifying the adult Chloropid flies of Jamaica is given. The localities in which each species was taken are recorded and nomenclature is in some cases briefly discussed. *H. turneri*, sp. n., and *H. saundersi*, sp. n., are described from the female and comments are made on three photomicrographs of the immature stages of *H. pallipes*, which were previously unknown.

NASH (T. A. M.). **The Part Played by Microclimates in enabling** *Glossina submorsitans* **and** *G. tachinoides* **to withstand the high Temperatures of a West African Dry Season.**—*Bull. ent. Res.* **27** pt. 2 pp. 339–345, 2 pls., 1 ref. London, July 1936.

The present paper gives the results of further work on the effect of high maximum temperatures on *Glossina morsitans submorsitans*, Newst., and *G. tachinoides*, Westw., in Northern Nigeria [*cf. R.A.E.*, B **23** 142]. As the previous experiments had been carried out in a grass hut where the climate was similar to that of shade conditions in the open fly bush evacuated in the dry season, preliminary experiments were carried out to ascertain whether the lower limit of the critical zone [*loc. cit.*] is the same within the forest where fly was numerous. Flies were kept in cages suspended from the lower branches of a tree where there was a canopy of high shade and an accumulation of débris at the base of the branches, which protected the cages from the sun. The experiment started with 39 examples of *G. tachinoides* and 41 of *G. morsitans submorsitans*, 1–7 days old, and fresh flies were added daily to keep up the population as in nature. Every morning for 6 weeks the number of deaths and the maximum temperature of the previous day were recorded, and the new and old flies were fed before being returned to the cages. Thus the greatest possible age of a fly at the end of the experiment was 7 weeks. It was concluded that with flies not older than 3 weeks the lower limit of the critical zone is 102°F., for both species. With flies not older than 7 weeks the lower limit for *G. tachinoides* appears to drop to 100·5°F., although the limit for *G. morsitans submorsitans* remains at 102°F. The adverse effect upon the older flies of a day when the maximum temperature enters the critical zone is continued for several days following, even though the maximum temperature on these days remains below the lower limit.

In parts of Northern Nigeria, especially near the large sand rivers that only flow in the rains, there remains closed forest in the form of riverine

strips or forest islands surrounded by savannah woodland. A patch of this residual forest is rarely a homogeneous unit, but is usually composed of clumps of true forest with a wind-break of protective peripheral thicket, which intrudes into the forest in tongues wherever there is an absence of high shade. In such a patch of forest maximum temperatures were recorded throughout the hot season (from 10th April to 31st May 1935) in a Stevenson screen and on thermometers placed in sites that were believed to represent all the probable microclimates that tsetse flies might frequent during the period of dangerously high temperatures. Eight of these were in the true forest and one in the intrusive thicket, where, being on the fringe, it had the advantage of some adjacent high shade.

The following is largely taken from the author's general summary: From the mean maximum temperatures recorded over 52 days in 9 microclimates, it would appear that sites on the ground are cooler than those above the surface; the difference is not very great, the mean for the 4 ground sites being only 4·4°F. lower than that for the 5 other sites. The evidence suggests that on very hot days only the ground within the true forest is safe for fly; in all other sites (above ground in the true forest or on the ground in the intrusive and peripheral thickets), the temperature is liable to enter the critical zone, and may even reach the upper fatal limit. The fly community is living very close to the critical zone in the late dry season. Even the coolest ground site showed an absolute maximum that was only 3·5°F. below the lower limit. Temperatures at a site only 20 feet from the edge of the forest at a point where there was no peripheral thicket indicated how severe conditions might become in the true forest if the wind-breaks of thicket were removed. In sites on the ground a shower of rain produces about twice as great an initial drop in temperature, and temperature remains abnormally low for about twice as long, as in sites above the surface of the soil. The duration of the period of dangerously high temperatures to which the fly community is subjected in the late dry season may be very varied; it depends on the incidence of rain in April and May.

These results confirm the author's previous conclusion that the fly lives very close to the critical temperature zone in the late dry season [*cf.* **23** 143] and support the suggestion that if the peripheral and intrusive thickets only were removed, the hot winds from the open burnt country might sweep through and so desiccate the forest floor that the microclimates on the ground would not be appreciably cooler than those above the ground. If the practical application of these results confirms the suggestion, it will be possible to leave standing the valuable timber and to clear only the useless thicket.

SCHULZE (P.). **Sind Säugetiere die ursprünglichen Zeckenwirte?** [Are Mammals the original Hosts of Ticks?]—*Zool. Anz.* **115** no. 1–2 pp. 19–24, 14 refs. Leipzig, 1st July 1936.

The author criticises Zasukhin's suggestion that mammals were the original hosts of ticks [*R.A.E.*, B **23** 261]. He suggests that the latter occurred long before the former and parasitised reptiles, though birds may be the original hosts of the Argasids, which separated from the other ticks relatively late.

Mlinac (F.) & Oswald (B.). **Preliminary Studies on the poisonous Properties of the Species of Ticks occurring in Jugoslavia. i.** *Hyalomma aegyptium* **L. (Neum.).** [*In Serbian.*]—*Jugosl. vet. Glasnik* no. 8 reprint 7 pp., 2 figs., 18 refs. Belgrade, 1936. (With a Summary in English.)

Seven species of ticks, *Hyalomma savignyi*, Gerv. (*aegyptium*, auct.) [*cf. R.A.E.*, B **24** 196], *Ixodes ricinus*, L., *Rhipicephalus bursa*, C. & F., *R. sanguineus*, Latr., *Haemaphysalis cinnabarina punctata*, C. & F., *Dermacentor reticulatus*, F., and *Boophilus annulatus*, Say, have been found in Jugoslavia by the authors. They show that the poisonous property of a tick can be proved not only by feeding it on animals but also by injecting into them an extract prepared from its eggs, and describe a method of preparing from eggs of *H. savignyi* an extract that permits exact dosage and sterile working. This extract, inoculated subcutaneously into the dorsal part of the neck of guineapigs, caused experimental tick-paralysis and death in about 6 days.

Sergent (Ed.), Donatien (A.), Parrot (L.) & Lestoquard (F.). **Etude morphologique du cycle évolutif de** *Theileria dispar* **chez le boeuf et chez la tique.**—*Ann. Inst. Pasteur* **57** no. 1 pp. 30–55, 1 pl., 6 figs., 38 refs. Paris, July 1936.

The authors give a detailed account of the life-history of *Theileria dispar*, the causal organism of the form of bovine piroplasmosis known as Mediterranean coast fever, in cattle and in the tick vector, *Hyalomma mauritanicum*, Senevet, and describe experiments made in Algeria that have a bearing on the morphological observations.

The following is largely taken from their summary : The schizogonic cycle takes place in the reticulo-endothelial system of cattle and induces a serious disease. The sporogonic cycle takes place in the tick in the course of one generation, from the larval-nymphal stage, which becomes infected on infected cattle, to the adult, which transmits the disease to healthy animals [*cf. R.A.E.*, B **19** 91]. Gamonts, which are formed in the reticulo-endothelial cells of cattle, give rise to gametocytes, which attach themselves to the red corpuscles and are thus carried into the general circulation. The gametocytes are ingested with the blood by the larval-nymphal stage of the tick and change into zygotes, which are found in the epithelial cells of the intestine of the nymph. The zygotes encyst and remain in that state in the lumen of the intestine during the hibernation period of 6–8 months. After the nymph moults, the zygotes lose their cysts and migrate to the acinous salivary glands. They penetrate the cells of the acini and form sporonts. In three or four days the sporonts give rise to sporoblasts, and these produce sporozoites, which find their way into the salivary ducts.

Certain experiments, which are described, were carried out to confirm the morphological observations. The developmental forms of *T. dispar* were seen in ticks fed on cattle harbouring the gametocytes and not in those fed in uninfected cattle imported from France. Ticks fed on blood containing the small intraglobular forms of the parasite transmitted the infection, whereas those fed on blood that did not contain these forms failed to do so, thus confirming the morphological observation that these are the gametocytes. Moreover, when ticks were fed in the larval-nymphal stage on a cow infected by inoculation of blood from one infected by means of ticks, no transmission took

place, although the blood contained large numbers of small annular forms. Thus the blood loses its power to infect the tick before the gametocytes disappear, and these would seem to have become sterile at the time of the transmission by blood inoculation. If by chance a tick in the larval stage becomes detached from its host and moults elsewhere, it has been shown by experiment that infection can be transmitted by the nymph, provided that a sufficient time has elapsed between the larval and nymphal feeds to allow for the sporogonic development of the parasite. In the case of nymphs that fed immediately after moulting infection was transmitted in the adult stage. Adults derived from nymphs that had already transmitted infection were not infective, so that a single feed would appear to remove all sporozoites from the salivary glands. When the tubular and acinous glands of the same batch of ticks were inoculated separately into two different animals, only the one inoculated with the acinous glands became infected, showing that these alone contain sporonts of *T. dispar*. Further experiments indicate that the sporozoites are transmitted to cattle generally from the third day after the attachment of the tick.

RICHARDSON (C. H.). **Flies as Household Pests in Iowa.**—*Bull. Iowa agric. exp. Sta.* no. 345 pp. 217–238, 13 figs., 2 refs. Ames, Iowa, May 1936.

Short notes are given on the appearance, life-history and habits of *Musca domestica*, L., and a number of other flies that enter dwellings in Iowa. The control measures discussed include various means of rendering breeding places unattractive or inaccessible to ovipositing females or unfit for the development of larvae, and the use of poison baits, sprays, fumigants and traps against the adults.

D'AMOUR (F. E.), BECKER (F. E.) & VAN RIPER (W.). **The Black Widow Spider.**—*Quart. Rev. Biol.* **11** no. 2 pp. 123–160, 7 figs. Baltimore, Md, June 1936.

An account is given of investigations carried out in 1934–35 in Denver on the life-history of *Latrodectus mactans*, F., and the properties of its venom. Descriptions are given of all stages of the spider, which is widely distributed in the United States, having been recorded from all the States except 7. In the laboratory a female that paired in August did not produce her egg-sac till July of the following year, but one that paired in June produced an egg-sac less than a month later. Females in captivity each produced 1–4 sacs, averaging 143 eggs in each with a maximum of 210. Hatching from the egg might apparently take place within a few days, but the young appeared to make their first moult before emerging from the sac in 2–3 weeks. The authors were not successful in inducing the young to feed upon anything except each other. Moults occurred at intervals of 9–18 days, complete development in favourable conditions taking at least 2–3 months.

The toxic principle of the venom was found to be a protein, probably an albumen. Various antidotes were tested with negative results. The preparation of a potent anti-venin from the rat is described, and a preliminary report covering similar results in the sheep is presented. The venom is shown to be chemically and serologically distinct from the poisonous principle of the eggs.

NEIVA (A.) & LENT (H.). **Notas e commentarios sobre triatomideos. Lista de especies e sua distribuição geographica.**—*Rev. Ent.* **6** fasc. 2 pp. 153–190. Rio de Janeiro, 15th July 1936.

The literature on the classification of Triatomids is reviewed, and annotated alphabetical lists are given of the 75 species considered valid by the authors, showing their synonymy, and of the countries in which they occur, showing the species found in each.

PAPERS NOTICED BY TITLE ONLY.

SCHARFF (J. W.). **Anti-malarial Drainage from the Point of View of the Health Officer.**—*Malayan med J.* **10** no. 4 pp. 119–137; **11** nos. 1–2 pp. 40–52, 67–90, 34 figs., 30 refs. Singapore, December 1935; March, June 1936. [Slightly enlarged version: *cf. R.A.E.*, B **23** 236.]

SCHARFF (J. W.). **On a Method of Planting and Growing Grass in connection with Anti-malarial Drainage Projects.**—*Malayan med. J.* **10** no. 4 p. 153, 1 ref. Singapore, December 1935.

PLAGENS (M.). **Zur Frage der Mückenbekämpfung.** [On the Question of Mosquito Control (a review of the literature on plants detrimental to mosquito larvae).]—*Mitt. naturw. Ver. Greifswald* **62** (1934) pp. 187–206, 3 figs., 26 refs. Greifswald, 1935.

ROZEBOOM (L. E.). **The Larva and Adult of *Culex rooti* Rozeboom.**—*Ann. ent. Soc. Amer.* **29** no. 2 pp. 266–267, 2 figs., 2 refs. Columbus, Ohio, June 1936. [*Cf. R.A.E.*, B **23** 208.]

KOMP (W. H. W.). **Description of nine new Species of *Culex*, seven from Panama and two from Venezuela (Diptera, Culicidae).**—*Ann. ent. Soc. Amer.* **29** no. 2 pp. 319–334, 27 figs., 3 refs. Columbus, Ohio, June 1936.

PHILIP (C. B.). **A new Horsefly** [*Tabanus subfronto*, sp. n.] **from the southeastern United States.**—*J. Kans. ent. Soc.* **9** no. 3 pp. 100–101. McPherson, Kans., July 1936.

KRÖBER (O.). **Drei neue *Poeciloderas*-Arten aus Paraguay. (Diptera: Tabanidae.)** [Three new Species of *Poeciloderas* (*frater, antennarum, paraguayensis*) from Paraguay.]—*Arb. morph. taxon. Ent. Berl.* **3** no. 3 pp. 221–223. Berlin, 25th July 1936.

PATTON (W. S.) & WAINWRIGHT (C. J.). **The British Species of the Subfamily Sarcophaginae, with Illustrations of the Male and Female Terminalia.** [Part III.]—*Ann. trop. Med. Parasit.* **30** no. 2 pp. 187–201, 8 figs. Liverpool, 17th July 1936. [*Cf. R.A.E.*, B **24** 63.]

BURTT (E.). **A simple and rapid Method for Extraction of the Salivary Ducts of Tsetse-fly** [*Glossina*], **suitable for Trypanosomiasis Examinations.**—*Ann. trop. Med. Parasit.* **30** no. 2 p. 265. Liverpool, 17th July 1936. [Modification of previous methods: *R.A.E.*, B **12** 58; **21** 286.]

LIU (CHI-YING). **On the unrecorded Male of the Bat Flea *Ischnopsyllus tateishii* Sugimoto (Siphonaptera)** (with further description of female).—*China J.* **23** no. 5 pp. 306–310, 2 figs. Shanghai, 5th November 1935. [Recd. August 1936.]

MacLeod (J.). *Ixodes ricinus* **in Relation to its Physical Environment. IV. An Analysis of the Ecological Complexes controlling Distribution and Activities.**—*Parasitology* **28** no. 3 pp. 295–319, 5 figs., 43 refs. Cambridge, July 1936.

In the previous papers of this series [*R.A.E.*, B **22** 161 ; **23** 136 ; **24** 18], the relation of *Ixodes ricinus*, L., to its physical environment was discussed in detail, studies being made of the factor complexes governing survival, activity, reproduction and development. In the present paper an attempt is made, from the results obtained in the laboratory, to interpret the observed phenomena of seasonal and local distribution in terms of the underlying causes and to outline the probable limits of potential world distribution of the species.

The following is substantially the author's summary : The biotic factors in the environment exercise little effect on the geographical or local distribution of the tick, or on its seasonal prevalence. Its local distribution is determined by edaphic factors, a wet, mossy, or peat soil and a dense mat or rank growth of vegetation being necessary for its survival. In Britain, the critical season for survival is summer, during which the moisture factor in the microclimate acts in a limiting capacity. The seasonal prevalence is determined by temperature. Within limits, which appear to correspond to air-temperature limits of 7 and 16°C. [44·6 and 60·8°F.] (weekly maxima), the unfed tick climbs the vegetation, and thus readily obtains a host. The mean temperatures of the months during which this range occurred varied from 5 to 10·5°C. [41–50·9°F.]. In Britain, the tick is inactivated in winter by the cold, and in summer it is less readily picked up by hosts because of its positive geotropic response to the stimulus of high temperatures. The summer is the optimum season for development, which also proceeds to some extent in winter. Autumn and spring are parasitisation seasons. The life-cycle, involving a parasitisation and a development season for each stage, requires a minimum of $1\frac{1}{2}$ years. The period may extend to $4\frac{1}{2}$ years. The possible world distribution of the species is limited primarily by temperature. Thus, microclimatic extremes of −14 and 35°C. [6·8 and 95°F.] limit the range through which the tick can survive. A period of at least three months with the mean air temperatures over 10°C. [50°F.] is necessary for development, while the mean air temperature of the coldest month must not exceed 10°C. to allow of parasitisation occurring. Within the areas delimited in relation to the temperature requirements of the tick, distribution is governed by the moisture factor. An index of the suitability of an area within the temperature limits is afforded by the type of vegetation ; forest and woodland, including grass and cultivation areas, as opposed to prairie and steppe, indicate suitable moisture conditions.

MacLeod (J.). **Studies in Tick-borne Fever of Sheep. II. Experiments on Transmission and Distribution of the Disease.**—*Parasitology* **28** no. 3 pp. 320–329, 11 refs. Cambridge, July 1936.

In the first part of this paper the author gives an account of experiments dealing with the history of the infective agent of " tick-borne fever " of sheep in the vector, *Ixodes ricinus*, L. [*cf. R.A.E.*, B **21** 127], and with the transmission of the disease by inoculation of suspensions of ticks.

The following is taken largely from the summary : Females that feed on a sheep infected with tick-borne fever are not capable of transmitting the infective agent to their progeny. Only the nymphs and females, therefore, can be infective to sheep. In the case of an infective female the infection may have been acquired in the nymphal stage, or in the larval stage ; in the latter case the infective agent remains in the tissues of the ticks during the nymphal engorgement and subsequent moult. This appears to occur whether the host on which the nymph feeds is susceptible to the disease or not. Ticks that acquire infection are infective as soon after moulting as they are able to attach themselves to hosts. Unfed ticks were not found to be infective after a period of about 14 months. Infection is transmitted to the sheep in the course of the second day after attachment of infective nymphs. The disease was successfully transmitted to sheep by inoculation of suspensions of infective ticks when serum from the sheep to be inoculated was substituted for the saline previously used [*cf. loc cit.*] in the preparation of the suspension ; activation of the virus by allowing the ticks to begin to feed before maceration would appear to be a desirable, if not a necessary, preliminary treatment.

In the second part of the paper the author discusses the possible distribution of the disease. The demonstration of the causal agent in ticks collected at random from apparently healthy sheep in various parts of Scotland suggests the probability that the disease is prevalent over all the hill country where ticks exist.

DUKE (H. L.). **Studies of the Effect on *T. gambiense* and *T. rhodesiense* of prolonged Maintenance in Mammals other than Man : with special Reference to the Power of these Trypanosomes to infect Man. I–II.**—*Parasitology* **28** no. 3 pp. 381–394, 13 refs. Cambridge, July 1936.

In the first of this series of papers, the author reviews published investigations on the behaviour of *Trypanosoma gambiense* in ruminants, and gives an account of recent observations on its behaviour in antelope, which lead him to conclude that the form of this trypanosome typical in East and Central Africa is unsuited to prolonged survival in situtunga, oribi or reed-buck.

In the second paper are collected all the records from the Entebbe Laboratory of experiments in which the pathogenicity of strains of *T. gambiense* that had been maintained for a time in laboratory animals was tested on man. In six out of seven strains it had remained unimpaired but in the seventh it appeared to have become weakened. A summary is also given of attempts to infect man with strains of *T. brucei* obtained from *Glossina* spp. in nature, either by the bites of infective flies or by inoculation ; the results were all negative.

LEESON (H. S.). **Further Experiments upon the Longevity of *Xenopsylla cheopis* Roths. (Siphonaptera).**—*Parasitology* **28** no. 3 pp. 403–409, 3 figs., 7 refs. Cambridge, July 1936.

Since the results of previous work on the longevity of unfed fleas [*R.A.E.*, B **20** 181] did not agree with those of other workers [*cf.* **13** 128], the experiments described were carried out to determine whether feeding would materially influence the longevity of *Xenopsylla cheopis*, Roths., and whether it would have any effect on the survival

of the sexes or upon the relationship between survival and saturation deficiency of the atmosphere. The fleas would not feed on the day of emergence and only a small proportion would feed on the first day following, but on the second day all would feed. In one set of experiments, therefore, fleas that had emerged two days previously were fed once before being isolated and placed in controlled atmospheres. In the second set of experiments unfed fleas less than 24 hours old were allowed to remain for 7 days in jars each containing a mouse. On the 7th day the fleas recovered from the mice and the débris were isolated and placed in controlled atmospheres. The results are discussed and compared with those of the previous experiments. It was again found that lower temperatures are more favourable to longevity than higher ones and that at any one temperature fleas live longer at higher relative humidities. The mean survival periods for both sexes at relative humidities ranging from 20–25 to 90 per cent. varied among fleas fed once from 8·1 to 10·3 days at 21°C. [69·8°F.] and from 5·7 to 7·7 days at 30°C. [86°F.], and among fleas fed repeatedly from 9·2 to 11·2 days at 25°C. [77·F.] and from 8·6 to 10·4 days at 30°C.

The following is taken from the author's summary: Fleas fed once before starvation lived longer than unfed fleas, but there was no difference between the durations of survival of the sexes and no direct proportion between longevity and saturation deficiency. Fleas kept with the host for 7 days before starvation lived still longer. Females lived considerably longer than males [*cf.* **15** 91], but there was still no direct relation between length of survival and saturation deficiency.

EVANS (A. C.). **Studies on the Influence of the Environment on the Sheep Blow-fly *Lucilia sericata* Meig. IV. The Indirect Effect of Temperature and Humidity acting through certain competing Species of Blow-flies.**—*Parasitology* **28** no. 3 pp. 431–439, 2 figs., 14 refs. Cambridge, July 1936.

In considering the effects of climate upon one species of an ecological complex, it is necessary to understand its effect upon associated species. In previous papers of this series [*R.A.E.*, B **22** 215; **23** 199], the direct effect of temperature and humidity on *Lucilia sericata*, Mg., was studied. In the present paper an account is given of an investigation on the comparative resistance to high temperature and various humidities of four of the principal species of English blowflies, *Calliphora erythrocephala*, Mg., *L. sericata*, *Sarcophaga barbata*, Thoms. (*falculata*, Pand.) and *Phormia terrae-novae*, R.-D. (*groenlandica*, Zett.).

The following is largely taken from the author's summary: It is shown that *P. terrae-novae* is the most resistant and *C. erythrocephala* the least resistant species, with *L. sericata* and *S. barbata* occupying an intermediate position. This order of resistance is correlated negatively with the order of the seasonal succession of the species. It is suggested that certain differences in the length of life of males and females subjected to various humidities is brought about by an "ageing" factor that is felt earlier and more strongly in the male.

NATTAN-LARRIER (L.) & GRIMARD (L.). **Existe-t-il des formes métacycliques dans les cultures de *Leishmania donovani*?**—*C. R. Soc. Biol.* **122** no. 24 pp. 993–996, 1 ref. Paris, 1936.

Adler and Theodor have described small flagellates in the proboscis of *Phlebotomus perniciosus*, Newst., experimentally infected with

Leishmania donovani, that they suggest might be the metacyclic forms. In cultures of *L. donovani* on ordinary N.N.N. medium no such forms have been seen. The metacyclic forms of certain trypanosomes only appear in old cultures, and a search was therefore made for the small type of flagellate in cultures of *L. donovani* on moistened N.N.N. medium, on which the flagellates conserve their vitality and continue to multiply often for more than three months. The small forms were seen in cultures 63–98 days old, and in a single instance in one only 33 days old ; they usually disappeared after 5–8 days. The similarity between these forms and those discovered by Adler and Theodor would suggest that they also are metacyclic forms, but there has been no experimental proof of the hypothesis of these workers and such proof would be still more difficult to obtain for the forms in old cultures.

von Frankenberg (G.). **Der " Blattlauslöwe " als gelegentlicher Parasit des Menschen.** [*Chrysopa vulgaris* as an occasional Parasite of Man.]—*Mikrokosmos* **29** no. 11 pp. 169–170, 5 figs. Stuttgart, August 1936.

The author has observed several instances in Germany of attack on the skin of man by *Chrysopa vulgaris*, Schn., parts where the skin is particularly tender, such as the curved side of the under arm, being chosen. Some pain is caused and after a few minutes a blister appears, leaving a red mark that may still be seen over 24 hours later.

Shew (W. D.). **Parasites of the Horse.**—*J. Dep. Agric. Vict.* **34** pt. 6 pp. 285–289, 6 figs. Melbourne, June 1936.

Brief notes are given on the bionomics and control of various parasites of horses in Australia, including bot-flies of the genus *Gastrophilus* [*cf. R.A.E.*, B **20** 38], the lice, *Haematopinus asini*, L., *Trichodectes pilosus*, Giebel, and *T. equi*, L. (*parumpilosus*, Piaget), the mite, *Chorioptes bovis equi*, Gerl., causing foot mange, and *Habronema* spp., which are carried by flies. Specifications are also given for making a dipping tank for horses, with instructions for preparing the concrete.

Jellison (W. J.) & Kohls (G. M.). **Distribution and Hosts of the Human Flea, *Pulex irritans* L., in Montana and other Western States.**—*Publ. Hlth Rep.* **51** no. 26 pp. 842–844, 1 map, 3 refs. Washington, D.C., 26th June 1936.

In view of the fact that sylvatic plague has recently been recorded from Montana and Oregon, the authors have collected the records, most of which have been obtained recently, of the occurrence of *Pulex irritans*, L., in Montana. It has been taken on dogs, coyotes (*Canis latrans*), and prairie dogs (*Cynomys ludovicianus*). Of 140 fleas collected from prairie dogs, 124 were *P. irritans* and only 16 the true prairie-dog flea, *Ceratophyllus* (*Opisocrostis*) *hirsutus*, Baker. The diversity of hosts and number of localities from which it has been recorded indicate that *P. irritans* has been well established in the region for some time. Examples of this flea have also been collected recently on coyotes in Colorado, Oregon and California, and on a deer (*Odocoileus* sp.) in Oregon.

Ohmori (N.). **On the Fleas of Formosa.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 3 pp. 158–164. Tokyo, July 1936.

A list is given of the fleas known in Formosa, showing their hosts, together with records of those that attack man [*cf. R.A.E.*, B **24** 38].

Chandler (A. C.). **Introduction to Human Parasitology.**—Demy 8vo, 5th edn, xvi+661 pp., 308 figs., 5 pp. refs. New York, John Wiley & Sons, Inc.; London, Chapman & Hall, Ltd., 1936. Price 25*s*. net.

Since the 4th edition of this work was published in 1930 [*cf. R.A.E.*, B **18** 128], the advance in knowledge in the field of parasitology has continued and so much important information has been obtained that it has again been necessary to re-write the book. In addition to the inclusion of new material, the arrangement in certain chapters has been extensively altered to make the presentation of the subject matter easier to follow, and some material omitted from the earlier editions has been incorporated.

Hoyer (D.), Zarkoski von Schmidt (S.) & Weed (A.). **Dosage-mortality Curve of Pyrethrum Sprays on the House Fly** *Musca domestica* **L.**—*J. econ. Ent.* **29** no. 3 pp. 598–600, 1 fig., 3 refs. Menasha, Wis., June 1936.

The percentage mortality obtained by using a definite amount of the active principles of pyrethrum varies according to the biological and chemical techniques of the laboratory making the test. A graph is given showing the percentage mortalities obtained among reared examples of *Musca domestica*, L., with dosages of pyrethrins covering the range of concentration found in commercial fly sprays. The dosage-mortality curve was determined by the Peet-Grady method [*cf. R.A.E.*, B **16** 255] in the modified form adopted by the National Association of Insecticide and Disinfectant Manufacturers, and the pyrethrin content of the spray by the method of H. A. Seil. For a definite pyrethrin content the mortality varied in different tests by about 8 per cent., a variation that is to be expected since different batches of flies reared under as uniform conditions as possible will show differences in resistance. The curve of toxicity of fly sprays containing less than 75 mg. pyrethrins per 100 cc. slopes downward abruptly as the pyrethrin content decreases, and a small increase in pyrethrin content in this region would therefore give a relatively large increase in toxic effect. Above this quantity the slope of the curve is more gradual. With sprays containing $\frac{1}{2}$, $\frac{3}{4}$, 1 and $1\frac{1}{4}$ lb. average good quality pyrethrum flowers (0·95 per cent. total pyrethrins) per U.S. gal., it was estimated that the limits of percentage mortality would be 37–45, 50–57, 60–66 and 70–75 respectively (an extraction efficiency of 90 per cent. being assumed).

Haseman (L.). **Possible Insect Carriers in the 1933 Outbreak of Encephalitis in Columbia, Mo.**—*J. econ. Ent.* **29** no. 3 pp. 618–621. Menasha, Wis., June 1936.

A serious epidemic of encephalitis in and near St. Louis (Missouri) was followed in 1933 by an outbreak at Columbia. The great abundance of mosquitos in both places at the times of the outbreaks led

investigators to suspect that they might be vectors of the disease. However, experiments carried out in Mississippi and Virginia, in which mosquitos that had bitten infected persons were allowed to feed on healthy ones, gave negative results. In St. Louis, the disease was most prevalent in those areas in which methods of sewage disposal were least satisfactory. In Columbia, most of the first cases were within half a mile of the principal sewage disposal plant and the city dumping grounds and practically all cases were within a mile ; moreover, most of them were in line with the prevailing winds from the disposal plant. It seems possible, therefore, that blowflies, which are associated with garbage, sewage, etc., and were present in immense numbers in Columbia during the autumn, may be incriminated as direct carriers. At the same time, large swarms of leafhoppers came into the towns and cities at night, apparently blown in from the country by the high winds. As these insects are known to carry virus diseases of plants and also to cause annoyance by biting man, they may also be suspected of transmitting viruses pathogenic to man.

OHMORI (N.). **Experimental Studies on the Influence of low Temperatures upon the tropical Bed Bug** (*Cimex hemipterus* **Fab.**). **Third Report. On the Influence of a Temperature of 6°C.** [*In Japanese.*]—*J. med. Soc. Formosa* **35** no. 3 (no. 372) pp. 624–644. Taihoku, Formosa, March 1936. (With a Summary in English.)

In continuation of previous experiments [*cf. R.A.E.*, B **23** 225], eggs, nymphs and adults of *Cimex hemiptera*, F., that were being reared in an incubator at 27°C. [80·6°F.] with a relative humidity of about 75 per cent., were exposed for various periods to a temperature of 6°C. [42·8°F.] with a relative humidity of 80 per cent. and then returned to the incubator. The percentages of eggs that hatched after exposures of 6, 12, 21 and 26 days were 94, 84, 8 and 0. Those that hatched did so in 6–8 days. The nymphs and adults did not feed during exposure, and nymphs that had engorged with blood before exposure did not moult. The order of resistance of the different stages was 4th instar, 5th, 3rd, female adult, 2nd instar, male adult, 1st instar.

When exposed to 6°C. for 83 days, all stages were killed, irrespective of whether or not they had fed before exposure, though those that had fed usually did not live so long. The reproductive power of the males was not affected by exposure for up to 38 days, and the spermatozoa in the females usually remained functional during and after exposure. Females did not oviposit at 6°C., but produced normal eggs after exposure for up to 28 days.

MORISHITA (K.). **On the Anophelines of the** *aitkeni*-**group in Formosa.** [*In Japanese.*]—*J. med. Soc. Formosa* **35** no. 3 (no. 372) pp. 583–590. Taihoku, Formosa, March 1936. (With a Summary in English.)

Descriptions are given of the adults and larvae of *Anopheles aitkeni* var. *bengalensis*, Puri, and *A. insulae-florum* Sw. & Sw. de G., which are found in forests in Formosa.

MORISHITA (K.). **Further Notes on the Anopheline Mosquitos in Formosa.** [*In Japanese & English.*]—*J. med. Soc. Formosa* **35** no. 4 (no. 373) pp. 888–897. Taihoku, Formosa, April 1936.

Anopheles gigas var. *baileyi*, Edw., is recorded for the first time in Formosa, at an altitude of 7,500 feet. Records, with notes on synonomy, are also given of *A. annularis*, Wulp (*fuliginosus*, Giles), *A. jeyporiensis* var. *candidiensis*, Koidz., and *A. lindesayi*, Giles (*pleccau*, Koidz.).

MA (Hsien-chen) & CHANG (Teh-ling). **Observations on the Maxillary Teeth of** ***Anopheles hyrcanus*** **var.** ***sinensis*** **Wiedemann in Shanghai Region.**—*Lingnan Sci. J.* **14** no. 4 pp. 611–615, 6 refs. Canton, 4th October 1935.

As Roubaud has suggested that the maxillary index of an Anopheline may indicate its feeding habits [*cf. R.A.E.*, B **16** 210], an examination was made of the maxillary armature of 500 females of *Anopheles hyrcanus* var. *sinensis*, Wied., collected during the summer of 1933 in village dwellings and animal sheds in the Kaochiao district of Shanghai. The number of teeth on both maxillae of each mosquito was divided by two to obtain the maxillary index of the individual. In 285 specimens the number of teeth on each maxilla was the same, but in the others the difference varied from one to five [*cf.* **21** 140]. The maxillary indices ranged from 13 to 21 ; the average was 16·23, which is higher than that for the same species in northern Indo-China [**21** 140] and would appear to indicate a zoophilous tendency [*cf.* **24** 46]. It was found that 69·1 per cent. of the females taken in houses and over 92 per cent. in each case of those caught in a privy, a man-baited trap, and cow and pig sheds had an index of more than 14.

WU (Liang-yu). **Investigations on natural Infections of Anopheline Mosquitoes with Malaria Parasites in Canton.**—*Lingnan Sci. J.* **14** no. 4 pp. 691–692, 3 refs. Canton, 4th October 1935. **A Study of Anopheline Larvae of Kwangtung Province, with Notes on their Relation to the Incidence of Malaria.**—*Op. cit.* **15** nos. 1–2 pp. 1–10, 265–274, 3 pls., 1 fig., 3 pp. refs. Canton, 30th January & 20th June 1936.

An account is given in the second paper of investigations begun in 1931 on the Anophelines that occur in certain localities in the Canton and Swatow areas of Kwangtung Province. The history of previous work on Anophelines in China is briefly reviewed. The species observed were *Anopheles minimus*, Theo., and *A. maculatus*, Theo., larvae of which usually occurred together in hill streams, *A. tessellatus*, Theo., larvae of which were found only in the plains, usually about 10 days after heavy rains, *A. jeyporiensis* var. *candidiensis*, Koidz., and *A. splendidus*, Koidz., both of which were rare, and *A. hyrcanus* var. *sinensis*, Wied., larvae of which could be found throughout the year, chiefly in marshes, ditches and ponds, although they also occurred in streams in the hills. The principal characters of the fourth-instar larvae of these six species are shown in a table, and a key is given to larvae of this instar for all species recorded from the Province.

During the period from May 1932 to June 1933, inclusive, the incidence of malaria increased in September, reached its maximum in November, and decreased rapidly to a minimum in January–March, after which it rose again. The four common species of Anophelines

were most abundant from September to December; their numbers decreased considerably in January but increased again slightly in the spring months. The rainfall in Canton was most abundant in June–August. This suggests that the larvae of these Anophelines, particularly those that breed in streams, do not thrive during the rains, which may wash them away, but that they occur in large numbers after a very wet season. Moreover, the temperature fell gradually from September to December, so that conditions became very favourable for breeding. The decrease of malaria in January–March coincided with the dry weather and the lowest temperatures of the year. The lowest relative humidity (67–70 per cent.) occurred from October to December and is apparently the most favourable for the survival of Anophelines, a finding confirming the conclusions of other workers that the incidence of malaria in this region is highest when the relative humidity is low. The relation of these four species to the transmission of malaria is discussed.

Between September 1934 and June 1935, Anophelines were examined for the presence of malaria parasites and the results are given in the first paper. The mosquitos were collected from the campus of Lingnan University and, once a week, near a stream in a few mat sheds built for a group of stone-cutters, many of whom suffered from malaria from time to time. Only *A. hyrcanus* var. *sinensis* was taken on the campus, but in the mat sheds *A. minimus* and, in small numbers, *A. jeyporiensis* var. *candidiensis* were also found. Only *A. minimus* harboured parasites, gut infections being found in September, October and December 1935 and in January, May and June 1936, and a single gland infection in June 1936.

LAMPRELL (B. A.). **A Discussion on the Infectivity Surveys and Feeding Habits of Anopheline Mosquitoes in the Oriental Region with Special Reference to Assam and Northern Bengal.**—*Rec. Malar. Surv. India* **6** no. 2 pp. 213–231, 20 refs. Calcutta, June 1936.

A comparison of the results of an investigation on the feeding habits of Anophelines in Assam and Bengal [*cf. R.A.E.*, B **24** 165] with those obtained by other workers showed that the findings relating to the same species in different areas were very divergent, and similar differences are also reported in the malaria infection rates of the same species. The question arises whether these variations should be attributed to fundamental differences in the biological and physiological characters of single species that are believed to be entomological entities, or whether they are the result of environmental conditions.

The following is taken largely from the author's summary: The results of investigations into the feeding habits of some Anophelines in Assam and northern Bengal [*loc. cit.*] were compared with the findings of observers in other parts of the Oriental Region, particularly the Netherlands Indies [**20** 167] and the Philippines [**22** 242]. The relative degrees of zoophilism in the different species are similar; for example, *Anopheles leucosphyrus*, Dön., is markedly anthropophilous in Assam and the Netherlands Indies, *A. minimus*, Theo., is markedly so in Assam and the Philippines, *A. vagus*, Dön., is markedly zoophilous in all three countries, and *A. maculatus*, Theo., occupies an intermediate position.

The results of dissections of 106,272 Anophelines carried out in Assam and northern Bengal up to the end of 1934 by Dr. G. C. Ramsay and his collaborators (including some figures not previously published) are recorded and compared with figures obtained by the Assam Medical Research Society [*cf.* **22** 142] and with those of workers in other parts of the Oriental Region in which the same species have been investigated [*cf.* **16** 41 ; **19** 163 ; **22** 90, etc.]. The reason for the wide variation of the results of experimental infection of mosquitos with malaria is discussed.

The following conclusions are drawn from a critical analysis of the data collected. In any species of Anopheline that cannot be divided on morphological differences into subspecies or varieties, the biological and physiological characters, including such characters as feeding preference and receptivity to malarial infection, are fundamentally identical in whatever country or district it is breeding. Variation in the "androphilic index" [*cf.* **24** 165] in mosquitos of the same species from different communities is dependent on the relative availability of the blood-food of preference in that community. The variation in the infectivity index in mosquitos of the same species from different countries or districts is dependent on differences in environmental factors, of which the relative availability of the blood-food of preference is one of the most important. Other possible factors are climate, affecting the average longevity of the species, and variation in the potency of the prevailing strain of *Plasmodium* in different localities to infect mosquitos, each strain conceivably having its own selective action on each species of Anopheline. Stress is laid on the great importance of estimating the relative density of potential vectors in any community in which control by selective anti-mosquito measures is undertaken.

NEOGI (S. K.). **Relation of the Salinity of the Breeding Places of *Anopheles sundaicus* with the Endemicity of Malaria in the Suburban Areas of Calcutta.**—*Rec. Malar. Surv. India* **6** no. 2 pp. 233–238, 1 map, 3 refs. Calcutta, June 1936.

Anopheles sundaicus, Rdnw., which has in recent years become more widespread in the suburban areas of Calcutta [*cf. R.A.E.*, B **24** 164], normally breeds in brackish water, but is able to adapt itself to waters of various degrees of salinity. In order to determine whether there was any relation between the rate of salinity of the water in which the local examples of *A. sundaicus* were breeding and the degree of endemicity of malaria in a given locality, data on the spleen rate of children, and on the number and salinity of the breeding places were collected during December 1935 in a number of villages near Calcutta. The coefficients of correlation between these three variables were found to be low, positive and insignificant. The coefficients of correlation between the spleen rate and the average salinity and between the spleen rate and frequency of breeding, deduced by the method of partial correlation, keeping the third factor constant, were also found to be low, positive and insignificant. It is therefore concluded that neither the increased frequency of breeding places of *A. sundaicus* nor their chloride content is associated with the endemicity of malaria in the suburban areas of Calcutta.

VISWANATHAN (D. K.). **Epidemic Malaria in Madras Presidency.**—*Rec. Malar. Surv. India* **6** no. 2 pp. 239–271, 8 charts, 23 refs. Calcutta, June 1936.

From a review of records of previous outbreaks of malaria in parts of Madras Presidency, it is concluded that these areas are liable to epidemics with a high mortality, and that such epidemics are associated with a marked increase in rainfall. A detailed description is given of the characteristics of an epidemic that occurred in two districts in 1933–34 and was associated with two consecutive years of unusually high rainfall. A brief mosquito survey in one of these areas showed that the main breeding places were in the irrigation channels, irrigated fields, pits and depressions around the village, and wells. In 1933 the level of the subsoil water was so high that for the first time for 30 years wet cultivation was employed. As *Anopheles culicifacies*, Giles, was the most prevalent Anopheline and the only one found infected among the 93 adults collected and dissected, it seems probable that it was the chief, if not the only, vector in the region. The author discusses the various theories put forward to account for outbreaks of epidemics, and points out that the recorded features of the epidemic described are consistent with the hypothesis that a prolonged period favourable for transmission not only facilitates the introduction of different strains of the parasite but also tends to permit an increase in virulence of local strains by repeated passage through man and mosquito. A marked increase in rainfall is followed after an interval of about 3 months by a distinct rise in the incidence of malaria. When, however, there is an increased rainfall in two consecutive years, multiple waves of malaria incidence occur at intervals, with a progressive increase in their amplitude and a greatly increased mortality. The lag of 2–4 months between the increased rainfall and the increased incidence of malaria in the two districts concerned was probably due to the low density of the population (163 per square mile), which must delay the production of large numbers of gametocyte carriers and consequently decrease the rate at which the mosquitos become infected and transmit the infection. There are no records to show the longevity of mosquitos in these districts, which usually have a low humidity. In view of the low density of population, it is possible that most of them die before transmitting the disease, so that the normal period of transmission is very short, a theory that would explain the very low spleen rate found in the inter-epidemic period.

MULLIGAN (H. W.) & BAILY (J. D.). **Malaria in Quetta, Baluchistan.**—*Rec. Malar. Surv. India* **6** no. 2 pp. 289–385, 4 pls., 1 fldg map, 7 graphs, 2 charts, 1 diagr., 37 refs. Calcutta, June 1936.

A detailed account is given of a malaria and Anopheline survey carried out at Quetta, Baluchistan, shortly after the earthquake, from 25th July to 9th October 1935 [*cf. R.A.E.*, B **23** 301]. The topography, climate, water-supply, population, occupations and trades, and communications of the town are briefly described, and the history of malaria is reviewed. The information obtained on adult Anophelines and their breeding places is dealt with first in a general way and then under each of the species collected. The intensity of malaria and its seasonal distribution are discussed and various suggestions are made as to the measures that should be taken in the reconstruction of the area to reduce the incidence of the disease in the future.

Of 14,072 Anophelines belonging to 13 species, 7,023 were taken as adults and 7,049 were bred from larvae and pupae. The numbers of adults of each species caught and reared were, with one exception, very similar. Only five species were sufficiently abundant to be of importance in the transmission of malaria, and dissection of 3,044 females revealed parasites only in *Anopheles superpictus*, Grassi (infection rate 4·9 per cent.), *A. culicifacies*, Giles (5·1 per cent.) and *A. stephensi*, List. (1·0 per cent.). As the adults of the first two species were respectively 2·3 and 1·3 times as abundant as the last, their relative potential danger to the community (estimated by multiplying their percentage infectivity by their relative prevalence) may be stated as 1·0 for *A. stephensi*, 6·6 for *A. culicifacies* and 11·3 for *A. superpictus*. The relative prevalence of these three species was confirmed by an analysis of larval catches for the same areas over the same period (using only collections made within one mile of the selected adult catching stations), the figures being 1·0, 1·2 and 2·0 respectively. In the Quetta area as a whole during the malaria season of 1935 there was much evidence that *A. superpictus* was the chief vector, *A. culicifacies* also important, and *A. stephensi* much less so. Diurnal resting places of Anophelines included occupied and unoccupied dwellings, both permanent and temporary, and animal shelters close to human habitations, and, in the field, deep, dark, cool shafts and tunnels of the kareze irrigation systems, and caves in hillsides. In outdoor resting places, *A. culicifacies* was caught less often than *A. superpictus*, and much more often than *A. stephensi*. The highest percentage of infected mosquitos was not necessarily found among the mosquitos resting in or near human habitations. Among reared adults the proportions of the sexes were approximately equal, but among those caught in nature females predominated; the possible reasons for this discrepancy are discussed. Little information was obtained regarding the overwintering of local Anophelines, but it seems probable that neither *A. stephensi* nor *A. culicifacies* overwinters in the adult stage, whereas observations on *A. superpictus* suggest that it enters a state of true hibernation. Both the other species had become scarce by the early part of October, but adults of *A. superpictus* were still abundant and many showed an increase in fat-body and an arrest of ovarian development.

Larvae of *A. superpictus* were most abundant in breeding places associated with the Hanna River and the Lora stream; those of *A. culicifacies* were not only prevalent in these places but were also found in numbers in irrigation channels and in impounded waters connected with them; and those of *A. stephensi* were found chiefly in the vicinity of the Lora stream and in the numerous springs and seepages lying between it and the railway. An analysis of 167 collections of larvae and pupae from various breeding places in the Quetta area showed that, with one exception, one or more of the three vectors were found in each, and all three were found in 77 collections, so that there is no opportunity of applying the principle of "species sanitation."

In considering each species separately, information is given where possible on its geographical distribution, relative and seasonal prevalence in Quetta, relation to the transmission of malaria, diurnal resting places, dispersion, preferential breeding places, and overwintering.

From a consideration of the spleen rate of children resident in the Quetta area, it is concluded that Quetta is situated in a valley as malarious as almost any part of India. There is a considerable amount

of evidence that the transmission season is restricted to a short period of the year, particularly July–September. As the maintenance of a large garrison in this area is considered to be imperative, and it is therefore probable that a large civil population will again grow up in proximity to the military station, the necessity for selecting for rebuilding those sites that are relatively free from malaria (or those that can cheaply and easily be freed from the disease) is emphasised. Detailed recommendations are made with regard to sites for buildings, since it is held that the amelioration of the malaria situation in such a large compact community is not only feasible but also a paying proposition. No method of malaria control by mosquito destruction has been devised that is cheap enough for the resources of most small Indian villages, and the only possible procedure to apply to the villages surrounding the area would appear to be the administration of quinine. Wherever possible, highly malarious villages should be removed from the vicinity of Quetta to healthier and more distant sites. The supply of water for irrigation is to be increased, and every effort should be made to restrict the amount admitted to Quetta and control its distribution in such a way as to prevent mosquito breeding. The numerous excavations and depressions should be filled with débris from the ruined city, or the surrounding territory should be levelled flush with the bed of the excavations. New excavations should be prohibited within three miles of the outskirts of the new Quetta. The formation of a Malaria Committee to obtain the co-operation of the various administrations operating within the Quetta area is suggested.

KINGSBURY (A. N.). **Annual Report of the Malaria Advisory Board (F.M.S.) for the Year 1935.**—Med. 8vo, 13 pp., 1 chart. Kuala Lumpur, 1936.

In Malaya, economy measures against Anopheline larvae, such as the brush method of oiling and the extension of the period between oilings from 7 to 10 days, have proved effective during a period of naturally low malaria incidence and have resulted in a considerable reduction in expenditure at a time of acute financial stringency. In certain areas, however, a reversion to the spray method of oiling at weekly intervals has been followed by a marked reduction in the number of reported cases of malaria [*cf. R.A.E.*, B **23** 273]. Tables are given showing details of the cost of oiling half-a-mile of drain of an average width of 2 feet by both brush and spray methods in various localities. Various larvicides containing cresols have been claimed to be highly toxic to mosquito larvae. A comparison of one of these with the M.D.B. mixture [Mosquito Destruction Board mixture, consisting of 45 parts solar, 15 parts heavy and 4 parts light oil] indicated that the immediate toxicity of the former was about three times as great as that of the latter, but that the "delayed" toxicity, as estimated after 24 hours was little, if any, higher. The cost of the larvicide containing cresol was about seven times that of the M.D.B. mixture A serious situation has arisen in connection with the maintenance of open cement drains, since it has been found that acid water, which does not affect the inert aggregate, attacks the cement, probably by converting the calcium carbonate formed by the setting of the cement into a soluble bicarbonate. Small particles of the aggregate are loosened and carried away, thus exposing fresh surfaces to the action of the acid. In this way deep pockets are formed in the inverts and sides, and in the

course of time holes appear. The problem is one of considerable importance, since drains carrying such acid water last only 6–8 years. Waugh Scott found that fascine drainage [*cf.* **22** 149] is suitable for use at the heads of small channels, and in such places it has worked satisfactorily for more than a year. The method is more economical than oiling, but the drains are liable to be damaged by cattle.

The survey of the coastal district of Selangor was continued [*cf.* **23** 273], and records are given of the adult Anophelines caught in two man-baited traps operated on the road from Klang to Kuala-Selangor, of the numbers found infected, and of larvae caught in the vicinity. Larvae of *A. hyrcanus* var. *sinensis*, Wied., and of *A. vagus*, Dön., which are generally supposed to breed in fresh water, were frequently found in association with those of salt water species such as *A. sundaicus*, Rdnw. As the rainfall increased *A. vagus* entirely replaced *A. sundaicus* in certain places. *A. baezai*, Gater, was found in three samples of water with a very high salinity. A list is given of the Anophelines caught in trains arriving at Kuala Lumpur from Penang and Singapore, with the numbers dissected. The only malaria parasites seen were in the gut of a female of *A. aconitus*, Dön., caught in June in a train from Penang.

KINGSBURY (A. N.). **Annual Report of the Institute for Medical Research (F.M.S.) for the Year 1935.**—Med. 8vo, 126 pp. Kuala Lumpur, 1936.

In connection with an investigation on the value of atebrin and quinine in malaria prophylaxis in Malaya, observations on the Anophelines of the two estates concerned were made under the supervision of G. H. Corbett. Lists are given of the species, showing the numbers taken in man-baited traps and cattle sheds, the numbers dissected and found infected, and the numbers of larvae. On one estate, situated on an isolated area of hilly land in the middle of a wide jungle swamp that provided ideal breeding places for *Anopheles umbrosus*, Theo., malaria transmission was intense when the experiment was begun, and the infection rate among 296 examples of this mosquito collected during August was over 10 per cent.

A rather more detailed account than the one already noticed [see preceding paper] is given of the Anopheline surveys that are being carried out under the supervision of E. P. Hodgkin and G. H. Corbett of the coastal district of Selangor. In connection with these surveys, an analysis of 159 samples of water from breeding places was made and the salinity, pH, and iron content are shown in a table. A list is given of the numbers and species of Anophelines from various localities dissected during the year, including those collected in trains; the only infection discovered was in the gut of an example of *A. aconitus*, Dön. [*loc. cit.*], a species that has not been found infected since 1928. The results of attempts made during 1935 to infect Anophelines artificially with malaria are shown in a table; all those that became infected have already been shown to be susceptible [*R.A.E.*, B **23** 60]. The 16 examples of the fruit bat (*Pteropus vampyrus*) examined during the year were all found to be infected with *Plasmodium* [*cf.* **23** 60], but no positive results were obtained in attempts to infect various species of Anophelines and Culicines, although some of all the species fed.

A detailed account is given of a large number of experiments carried out by R. Lewthwaite and S. R. Savoor on the transmission of the

rural and urban types of tropical typhus by *Xenopsylla cheopis*, Roths. [*cf.* **24** 29, 141]. It was found that the urban strain could be transmitted to guineapigs by inoculation of suspensions of fleas fed on infected rats, and that inapparent infections were produced by rubbing a suspension of infected fleas or of their faeces into scarified areas on the skin of guineapigs. It was also transmitted by fleas transferred from infected to healthy rats. To determine whether there was multiplication of rickettsiae within *X. cheopis*, fleas were placed with infected guineapigs for 9 days and starved for 1 day, after which they were made into a suspension and centrifuged. The supernatant fluid was inoculated into guineapigs in dilutions equivalent to from 1 to 0·001 flea and all the animals reacted. When fleas were fed for a further period of 9 days on an infected, a normal, or an immune animal, the fraction necessary to cause infection increased in all cases from 0·001 to 0·1.

The rural or scrub type of virus was transmitted by fleas, from infected to healthy guineapigs that had been kept on a deficient diet [*cf.* **24** 141]. Attempts to transmit it by rubbing suspensions of fleas that had fed on infected guineapigs into scarified areas on healthy guineapigs gave inconclusive results, and in a single experiment in which a suspension of faeces was used in the same way no evidence of infection was obtained. Experiments to test the longevity of the virus in infected fleas indicated that it survived for at least 19 days. Dissections of fleas on the 4th and 18th days after their first infecting feed showed on both occasions in the mid-guts of one of four fleas a few organisms morphologically resembling *Rickettsia orientalis*, which differs considerably from the *Rickettsia* of the urban type of typhus. The duration of the infectivity of fleas and the fact that the virus appears to be modified after transmission through these insects suggest an intravector phase rather than mere survival in the invertebrate host. The virus of rural typhus on first passage to guineapigs causes an essentially inapparent infection, not more than 6–10 per cent., of the animals reacting with fever. The virus of tsutsugamushi disease, which is serologically and immunologically identical [**24** 141], behaves in a similar manner. The rural strain used in the present experiments was isolated over four years ago ; in many of the earlier passages its existence was precarious, but, at length, after continued passage through guineapigs on a deficient diet, such constant findings as fever, peritoneal exudate and mortality were obtained. The results of the present study indicate the possibility of a reversion, after passage through fleas, to the character of the virus in early passages through guineapigs. When this strain is passed through rats or rabbits no essential modification occurs.

[Oganov (L. I.), Nabokov (V. A.) & Beklemishev (V. N.).] **Оганов (Л. И.), Набоков (В. А.), и Беклэмишев (В. Н.). Sur l'analyse et l'évaluation des résultats de la lutte contre les larves d'*Anopheles*.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 pp. 155–170, 8 graphs, 8 refs. Moscow, 1936. (With a Summary in French.)

From several years' experience in the Russian Union, the authors conclude that systematic observations on the density of mosquitos in their daytime resting places is a reliable method of verifying the effectiveness in controlling the larvae of applications of Paris green

dust from aeroplanes and determining the causes of failures. They discuss several types of seasonal curves showing the density of the population of *Anopheles maculipennis messeae*, Flni., in daytime shelters in the environs of Moscow where dusting from aeroplanes was carried out in 1933–35 ; the success of the work or its complete or partial failure are indicated and the causes of the latter explained. If one of a series of applications of dust is made too late so that pupae are already present, an increase of the numbers of mosquitos results within 5 days. If larvae of the third and fourth instars survive, owing to defects in the technique of dusting, the adult mosquito population increases in 10–15 days, whereas if larvae of the first instar survive, the increase takes place in about 20 days. A curve showing a steady drop in the abundance of mosquitos from a maximum at the end of May and beginning of June when the overwintered adults occur is only obtained if dusting has been completely effective and no breeding places have been overlooked. If the object of a dusting campaign is not to reduce the number of Anophelines to a figure that is negligible from the point of view of malaria transmission, but is merely to prevent an increase of their normal seasonal abundance, it is impossible to estimate its success unless the normal seasonal curve of the population is known. There are two main types of the summer incidence of *A. maculipennis*, the northern and the southern. In the former type, which is characteristic in central Russia, the number of Anophelines in daytime shelters increases in the spring owing to the gradual appearance of overwintered mosquitos, and then diminishes as the latter die out ; a gradual increase occurs again from the beginning of June and lasts till August, when the mosquitos begin to migrate to hibernation quarters.

[SHVETZ (S. I.) & LAPPIN (G. I.).] **Швец (С. И.) и Лаппин (Г. И.). Sur l'action larvicide des produits résiduels de naphte. Communication préliminaire.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 pp. 171–173. Moscow, 1936. (With a Summary in French.)

In the course of investigations in the Azov-Black Sea region on residues obtained in the process of distillation of crude petroleum by cracking, laboratory tests were carried out with five of the residues against the larvae of *Anopheles maculipennis*, Mg. Their composition is as yet unknown. Two of the residues produced stable films on the water and killed the larvae rapidly, being much more effective than crude oil. They had no effect on *Gambusia* though the films were maintained by supplementary applications for 3 weeks.

[LATUISHEV (N. I.).] **Латышев (Н. И.) Expérience d'application de certains dérivés de benzol dans la lutte contre les tiques** *Ornithodorus papillipes*. **Communication préliminaire.** [*In Russian.*] —*Med. Parasitol.* **5** no. 2 pp. 174–178, 3 refs. Moscow, 1936. (With a Summary in French.)

An account is given of experiments carried out in the summer of 1935 in western Tadzhikistan on the use of paradichlorobenzene and polychlorides against *Ornithodorus papillipes*, Bir., which is the vector of relapsing fever in Central Asia. Laboratory tests showed that these fumigants would kill the ticks even if they were covered with a

6 in. layer of loess, polychlorides acting more quickly and in smaller doses than paradichlorobenzene.

Experiments were then made in a large cave in which *O. papillipes* and rats were numerous. The latter probably acted as reservoirs of relapsing fever, as two were found to contain spirochetes in their blood, which produced the disease when inoculated into guineapigs. Small crystals of paradichlorobenzene were thoroughly mixed with the 2 in. layer of loess that covered the floor of the cave at the rate of 15 oz. per sq. yd., and several large crystals were buried in the corners of the treated area. Only part of the cave was treated. Repeated examination of the loess from the fifth day after treatment revealed the presence of dead ticks of all stages ; no ticks were ever found on the clothes of people who had been in the cave, whereas usually 10–15 individuals would occur on them even after a short stay in it. Live ticks were found on the 23rd day after the treatment ; they may have belonged to the new generation or may have migrated from the untreated part of the cave. No tests were made of the effect of the fumigant on the eggs. The rats were not affected.

[VINOGRADSKAYA (O. N.).] **Виноградская (О. Н.) Le cycle gonotrophique d'** *Anopheles superpictus* **Grassi comparé à celui d'** *A. maculipennis sacharovi* **Favr.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 pp. 192–202, 1 fig., 9 refs. Moscow, 1936. (With a Summary in French.)

A detailed account is given of observations in August–October 1934 in southern Kazakstan on the gonotrophic cycle of *Anopheles superpictus*, Grassi, and *A. sacharovi*, Favr, made by dissecting 1,018 females of the former and 119 of the latter. In the case of *A. sacharovi* a complete suspension of sexual and feeding activities usually occurred from the beginning of September, and was accompanied by the development of fat-body. No case of partial gonotrophic dissociation [*R.A.E.*, B **22** 77] was found, though there were frequent instances of the occurrence of excessive fat-body in the presence of normal ovarian development. In the locality where these investigations were conducted, *A. sacharovi* cannot therefore be of importance in the transmission of malaria in autumn. Of the total number of females of this species dissected, 4·7 per cent. contained oöcysts or sporozoites in August, whereas in September the figure dropped to 1·1 per cent., the mosquitos having probably contracted the infection in August.

The gonotrophic cycle of *A. superpictus* was normal in August, but from the middle of September 40 per cent. of the females possessed fat-body and still continued to feed, though ovarian development had ceased (complete gonotrophic dissociation). Only isolated cases of complete development of the ovaries after one blood-meal occurred in October. Owing to the condition of gonotrophic dissociation, the females need not abandon their shelters for oviposition ; repeated blood meals, resulting in the transmission of infection indoors, are, therefore, probable. The percentages of females that continued to digest blood were 68 in August, 51 in September and 67 in October. It is concluded, therefore, that this species is of primary importance in the transmission of malaria in the district in autumn. Its infection indices in August, September and October were 3·6, 4 and 7·4 per cent. respectively.

[MINAEV (G. I.) & KRAVCHENKO (F. P.).] **Минаев (Г. И.) и Кравченко (Ф. П). Sur les abris d'hiver de l'** *Anopheles maculipennis messeae* **Fall. dans les régions méridionales du Département de Krasnoyarsk (Sibérie).** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 pp. 211–219, 1 graph. Moscow, 1936. (With a Summary in French.)

Attempts to find the hibernation quarters of *Anopheles maculipennis*, Mg., in the environs of Minusinsk in the south-west of Eastern Siberia were begun in the winter of 1932–33. They were unsuccessful, however, until the spring of 1935, when large numbers of overwintering mosquitos, all of which were *A. maculipennis messeae*, Flni., were found on a farm in a cellar where potatoes were kept. By placing traps over the openings in the cellar, it was found that the mosquitos began to leave it on 28th April, and finished doing so on 6th June. The numbers of mosquitos that left the cellar increased as the temperature rose; 80 per cent. flew out between 2nd and 18th May at a mean temperature of 6·1–14·7°C. [about 43–58°F.]. Wind had no effect on their flight. Hardly any hibernating females of this Anopheline were found on other farms where examinations of quarters that were likely to harbour mosquitos in winter were made. It is concluded, therefore, that in the environs of Minusinsk hibernation chiefly takes place in the field. This was confirmed by the fact that 25 Anopheline females were caught at various dates in April and May in traps placed in burrows of ground squirrels [*Citellus*], and several were observed leaving the burrow of a fox. The destruction of mosquitos in winter in houses would, therefore, be useless [*cf. R.A.E.*, B **23** 76].

[KISELEVA (E. F.).] **Киселева (Е. Ф.). Sur la faune des Culicidae de la Sibérie.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 pp. 220–240, 1 map, 39 refs. Moscow, 1936. (With a Summary in French.)

Records based on personal observations in 1929–31 and collections by other workers in 1930–35 are given of the occurrence of 32 species of mosquitos in the west and extreme north of Siberia, with notes on their distribution and biology. Six species are recorded for the first time from Siberia, of which one, *Culex sibiricus*, is described as new. The only Anophelines found were *Anopheles claviger*, Mg. (*bifurcatus*, auct.) and *A. maculipennis*, Mg. *A. maculipennis* is very abundant in the environs of Tomsk; the structure of the eggs indicates that the race concerned is closely allied to *messeae*, Flni. It has 3 generations a year, the females entering hibernation between 10th and 15th September, though larvae may be observed as late as October. Hibernation takes place in sheds, storehouses, basements and cellars, and only rarely in inhabited rooms. In the summer the mosquitos are chiefly to be found in cow-sheds. The larvae occur in permanent accumulations of water, such as lakes formed by the flooding of the river, having flat banks covered with meadow vegetation, but not in those surrounded with dense growth of bushes. A few were found in pine forests, provided that the water was exposed to light and had submerged aquatic vegetation.

[VAÏNSHTEÏN (N. B.).] **Вайнштейн (Н. Б.). On the Technique of forced Feeding of Mosquitos.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 p. 288. Moscow, 1936.

In using the method of artificial feeding of mosquitos described by Kadletz [*R.A.E.*, B **17** 200], the insect is held between a piece of

glass and a piece of thin paper, and may easily be injured. A modification of the method is, therefore, recommended in which two Pasteur pipettes are used, one for holding the mosquito and the other for the liquid on which it is to be fed. The pipette for the mosquito is the larger in diameter, and one of its ends is narrow. The feeding pipette has one end drawn out into a capillary tube that easily enters the opening in the narrow tip of the larger pipette. The mosquito is removed from the cage by means of an absolutely dry test tube and is introduced into the larger pipette head forwards ; a small pad of cotton wool is then inserted, by means of which the mosquito is gently pushed towards the narrow tip, where it is unable to move. The end of the feeding pipette is then introduced into the tip of the larger pipette so that the proboscis of the mosquito enters the capillary tube. After feeding is over, the cotton pad is removed with a wire hook, and the engorged mosquito is shaken out. An advantage of the method is that the mosquito can be easily observed in the transparent pipette.

[Il'inskiĭ (S. P.).] **Ильинский (С. П.). Data on the Phenology of Malaria Mosquitos. Important Dates in the Life of *Anopheles maculipennis* in Orenburg in 1935.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 pp. 289–291. Moscow 1936.

A brief account is given of the seasonal occurrence and abundance of *Anopheles maculipennis messeae*, Flni., in a country resort near Orenburg in 1935 [*cf. R.A.E.*, B **24** 228]. On 13th April all overwintered females had abandoned their hibernation quarters and the first engorged individual was observed. The first batch of eggs was found on 30th April and the first male adult on 27th May. The development of the first generation from egg to adult was completed in 27 days. The beginning of the accumulation of fat-body was observed on 20th July, and the last oviposition took place on 1st October. From the beginning of August the females began to congregate in uninhabited buildings, and all had entered hibernation by 1st October.

[Danilova (M.).] **Данилова (М.). Observations on the Ecology and Classification of *Anopheles* in the Districts of Staro-Minsk and Novo-Minsk in the Azov-Black-Sea Region.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 p. 291. Moscow, 1936.

Observations on *Anopheles maculipennis*, Mg., in daytime shelters were carried out from the end of June till 1st October 1935 in two districts in the region of the Azov Sea in northern Caucasus. Of about 4,000 females dissected, 10 contained oöcysts of malaria parasites. Examinations of the batches of eggs collected in different localities showed that they belonged to race *messeae*, Flni., which predominated, and race *atroparvus*, van Thiel ; in the environs of Novorosiĭsk, however, on the Black Sea, all the eggs found, with the exception of one batch of *messeae*, belonged to the typical race *maculipennis*. Other Anophelines observed in Azov region were *A. hyrcanus* var. *pseudopictus*, Grassi, and *A. claviger*, Mg. (*bifurcatus*, auct.).

[Polikarpova (L. I.).] **Поликарпова (Л. И.). Varieties of *Anopheles maculipennis* in Stalingrad and its Environs.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 pp. 291–292. Moscow, 1936.

Examination in June-September 1935 of 119 batches of eggs laid in insectaries by females of *Anopheles maculipennis*, Mg., taken in different

localities in the district of Stalingrad showed that race *messeae*, Flni., is present on both banks of the Volga, whereas the typical *maculipennis* only occurs on the right high bank. This confirmed the findings of previous investigators [*R.A.E.*, B **23** 108, 287].

BARBER (M. A.). **A Survey of Malaria in Cyprus.**—*Amer. J. trop. Med.* **16** no. 4 pp. 431–445, 5 refs. Baltimore, Md, July 1936.

Details are given of the results of a malaria survey carried out in Cyprus between 22nd June and 2nd August, 1935. Spleen examinations in a number of villages indicated that the malaria incidence in the Island is high. Among 399 samples of infected blood the percentages infected with *Plasmodium vivax*, *P. falciparum* and *P. malariae* were 33·3, 42·0 and 24·5. There was no definite association of a given malaria parasite with the species of *Anopheles* prevalent in the village at the time of the survey. Little additional information on Anopheline breeding places was obtained [*cf. R.A.E.*, B **22** 210], except on the occurrence of eggs. Early in July in the vicinity of a village in which adults of *A. superpictus*, Grassi, and *A. sacharovi*, Favr (*elutus*, Edw.) were abundant, and those of *A. multicolor*, Camb., were also present, eggs of the first two were found in a brackish lake, and eggs of the last two were numerous in fresh water. Later in the month, when the lake diminished in size and became more brackish, the eggs of *A. multicolor* persisted in smaller numbers, but those of *A. sacharovi* were no longer found, although they were still being deposited in fresh water nearby. No examples of *A. maculipennis*, Mg., were seen although searches were made for eggs in many types of water and for adults among those reared from larvae or pupae in the laboratory or taken in daytime resting places [*cf. loc. cit.*]. *A. claviger*, Mg. (*bifurcatus*, auct.) was found in mountain localities and in wells, always in cooler waters. *A. algeriensis*, Theo., and *A. hyrcanus*, Pall., were not seen ; they are apparently rare in July. From a comparison of the density of adult mosquitos in houses and stables with the parasite indices of school children, it would appear that there is no close relation at a given date between the density of adult mosquitos and the amount of malaria. In some villages where malaria was very prevalent, only a few Anophelines could be found, but these sometimes showed a high sporozoite index. Possibly they were survivors of larger numbers present earlier in the season. Mosquitos were collected from houses and stables in 24 different villages between 27th June and 31st July ; sporozoites were found in 1·8 per cent. of 428 examples of *A. sacharovi* and in 7·8 of 1,134 of *A. superpictus*, but in none of 37 of *A. multicolor*. In villages in which *A. sacharovi* was present in any numbers, the parasite rate in children was almost always high, whereas in villages where there were considerable numbers of *A. superpictus* with a high sporozoite index, it was often low ; in the latter mosquito the parasite index may be higher later in the season, since it becomes active later than *A. sacharovi*. In any case, however, a given percentage of infected *A. superpictus* seems to cause less malaria than the same or a lower percentage of infected *A. sacharovi*. This may be partly due to the fact that deviation to domestic animals is more pronounced in *A. superpictus* and degeneration of sporozoites, often found in both mosquitos, is more common in this species. Few of the domestic animals spend the night in stables and a large proportion of the people spend the night in the open ; thus it is not surprising that the number

of mosquitos collected from stables and found by precipitin tests to contain human blood was high, since mosquitos biting man in the open are as likely to seek stables as houses for daytime resting places. It is concluded that the deviation of mosquitos to domestic animals is less marked than in many malarious countries. The relative importance of the different species of Anophelines in the transmission of malaria is briefly discussed. Observations on the radius of dispersion indicate that even partial control of breeding places, although not wholly effective in protecting villages nearby, may be of value to villages more distant, since the radius of dispersion is more or less proportional to the number of mosquitos being produced. The recommendations for future anti-malaria work include the distribution of *Gambusia* in all permanent water and the use for irrigation of various streams where Anophelines breed.

Earle (W. C.). **The Relative Importance of** *Anopheles tarsimaculatus*, *Anopheles argyritarsis*, **and** *Anopheles pseudopunctipennis* **as Vectors of Malaria in the Windward Group of the West Indies.**—*Amer. J. trop. Med.* **16** no. 4 pp. 459–469, 3 refs. Baltimore, Md, July 1936.

Accounts are given of the malaria situations in Grenada and St. Lucia, the information regarding the former having already been noticed from a more detailed source [*R.A.E.*, B **23** 28]. In St. Lucia. an island about as large as Grenada but with a smaller population, a survey was made in 1933. All the towns are on the sea-coast, and at Castries, the seat of government, conditions are similar to those in the less malarious sections of Grenada, since the mountains rise abruptly from the sea-shore. A considerable amount of mosquito breeding takes place in the numerous ravines. Larvae of *Anopheles tarsimaculatus*, Goeldi, were found in enormous numbers in large mangrove swamps immediately adjacent to two towns; and in two large, fertile, well-populated river valleys, planted with sugar-cane, they were taken in the numerous ditches as far as 2 miles from the sea-shore. The parasite indices in man were 66 per cent. in the two towns and a little over 50 per cent. in the two valleys. The only Anophelines found were *A. tarsimaculatus* and *A. argyritarsis*, R.-D.; the latter was not sufficiently abundant at the time of the survey to permit of study, but it was usually collected away from the sea-shore. A sporozoite index of 1 per cent. and an oöcyst index of 3·7 were found in females of *A. tarsimaculatus*, which were readily taken in houses. Oöcysts in all stages of development were observed; in one case 52 were seen in one stomach. In spite of the high indices there was little clinical malaria at the time of the survey. Notes are given from the literature on experimental and natural infections in *A. pseudopunctipennis*, Theo., *A. argyritarsis* and *A. tarsimaculatus* and on their distribution. It is concluded that *A. tarsimaculatus* is responsible for the transmission of most if not all the malaria in Grenada and St. Lucia.

Rozeboom (L. E.). **The Rearing of** *Anopheles albimanus* **Wiedemann in the Laboratory.**—*Amer. J. trop. Med.* **16** no. 4 pp. 471–478, 2 refs. Baltimore, Md, July 1936.

Owing to the difficulty of finding sufficient larvae of *Anopheles albimanus*, Wied., in the vicinity of Panama from which to obtain adults

for experiments, the author developed a technique, which is described in the present paper and has been successfully used for almost four months, for rearing it in large numbers in the laboratory. The technique for the larvae is very similar to that used by Boyd, Cain and Mulrennan [*cf. R.A.E.*, B **23** 283]. The most satisfactory results were obtained with infusions of lucerne hay. These are made in large glass jars, and after they have ripened for at least 2 months and probably more, a small amount is placed in a breeding pan and diluted with tap water for rearing larvae. Heavy cultures of *Paramecium* always develop in the infusions, and the period of usefulness of the water for rearing seems to terminate at about the time the cultures of *Paramecium* begin to die out. The yeast is placed on a glass slide supported just below the surface of the water by corks. Water baths are unnecessary, owing to the uniformity of the climate, but it has been found advisable to keep the pans out of doors, because the heavy rains make it necessary to close the windows of the laboratory at night and the high temperatures reached appear to favour the growth of micro-organisms to an extent that is inimical to the larvae. The breeding pans are kept in a room open on three sides and protected from the rain by a corrugated iron roof.

Pupae are collected at least once a day and placed in cups of tap water. Adults emerge into lantern globes and are subsequently transferred to the breeding cage. They pair in a relatively small space, but must be protected from the wind and need plenty of moisture. One side of the screen cage ($2\times2\times2$ ft.) is taken up by a sleeve of unbleached muslin, the other three are lined with white butter-muslin, which helps to exclude the draught and forms a suitable surface for the adults to rest on and a good background for observation. On the outside, these three sides are covered with thick twilled cotton material, which protects the adults from the wind and helps to prevent a rapid decrease in humidity within the cage. The floor is covered with heavy white paper to keep out the draught and the top with a wet towel beneath a piece of thick cardboard, which seems to diminish the rate of evaporation to the outside. As the towel does not give off quite enough moisture, a section of unglazed drain tile, 12 inches long by 5 inches in diameter, is placed in the cage. One end of this is plugged with paraffin wax, against which is packed a rag, and the remainder of the inside is filled with fine sand. About half a cup of water is poured into the tile each day and the surface, as the moisture oozes through, becomes cool and damp, but not sticky, so that the adults can rest on it. Shortly after the use of the tile was introduced, egg production suddenly increased, and it was concluded that it kept the moisture content of the cage up to a level at which much larger numbers of females were able to live long enough to deposit their eggs. The temperature in the cage varied from 80 to 86°F. Eggs are laid in dishes containing diluted hay infusion with cork floats to support the ovipositing females. An inverted flower pot supported so that the edge is 2 inches above the edge of the dish helps to reduce the number of pairing adults that fall into the water. Cellucotton pads soaked in sugar-water are placed on top of the cage beneath the towel so that the males can feed without becoming stuck to the cellucotton ; they are also given fresh fruit daily. The females are fed once a day on the human arm, since this is less troublesome than using laboratory animals and precludes the possibility of the development of a strain that might prefer animal to human blood. It is unnecessary for the arm to remain in the cage for

more than 5 minutes, as from 100 to 200 females take blood during that time. The donor has become almost immune from reaction to the bites of this mosquito.

ROZEBOOM (L. E.). *Triatoma dimidiata* **Latr., found naturally infected with** *Trypanosoma cruzi* **Chagas in Panama.**—*Amer. J. trop. Med.* **16** no. 4 pp. 481–484, 7 refs. Baltimore, Md, July 1936.

Trypanosoma cruzi was found in the excreta of 3 out of 19 examples of *Triatoma dimidiata*, Latr., collected from a house in Panama when they came out of their hiding places at night to feed on the inhabitants. An infected nymph transmitted the infection to a healthy guineapig on which it fed several times ; this is the fourth vector found in this region [*cf. R.A.E.*, B **21** 284 ; **22** 145]. None of the inhabitants of the house were infected. Two of the bugs when placed in a small bottle paired readily ; it would appear, therefore, that a nuptial flight is not essential [**23** 41].

[**Mosquito Control Work in 1935.**]—*Proc. N. J. Mosq. Ext. Ass.* **23** 210+3 pp., 8 figs., refs. New Brunswick, N.J., 1936.

In addition to reports on local mosquito situations and control work in New Jersey, Connecticut, Delaware, Illinois, New York State and New York City, the following papers are included : The Effect of the Depression upon Mosquito Control and how it may be overcome, by J. G. Lipman (pp. 53–56) ; A Résumé of Work on Mosquitoes throughout the World in 1935, by F. C. Bishopp and C. N. Smith (pp. 57–86) ; Mosquito Suppression Work in Canada in 1935, by A. Gibson (pp. 88–98) ; Information needed for a proper Understanding of the Effects of Mosquito Control Work on the Wildlife of Tidal Marshes, by I. N. Gabrielson (pp. 156–163) ; Additional Information needed concerning the Biology of Mosquitoes, by L. L. Williams jr. (pp. 163–166) ; Protection of Outdoor Gatherings from the Mosquito Pest, by J. M. Ginsburg (pp. 166–173), which deals with the use of a spray prepared from the New Jersey larvicide [*cf. R.A.E.*, B **24** 34] ; Salt-marsh Vegetation and its Relation to Mosquito Control, by L. A. DeVido (pp. 196–203), in which different types of salt-marsh vegetation are described and it is shown that they are correlated with the character of the marsh and consequently serve to indicate its suitability for mosquito breeding ; and Mosquito Control Facts taught by the Passing Years, by T. J. Headlee (pp. 204–209).

ZUMPT (F.). **Die Bekämpfung der Tsetsen mittels Fallen im Pflanzungsgebiet des Kamerunberges.** [The Control of Tsetse Flies by Traps in the Plantation Districts of the Hill Region in the Cameroons.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 3 pp. 197–202, 2 figs. Berlin, 15th August 1936.

This is an account of the construction and use of the traps for *Glossina* devised by Harris, Swynnerton and Chorley [*cf. R.A.E.*, B **21** 113, etc.], which are advocated for the extensive German plantations in the British Cameroons.

WEYER (F.). **Kreuzungsversuche bei Stechmücken** (*Culex pipiens* **und** *Culex fatigans*). [Crossing Experiments with Mosquitos.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 3 pp. 202–208, 4 figs. Berlin, 15th August 1936.

Experiments at Hamburg in crossing either sex of the autogenous, stenogamic race of *Culex pipiens*, L., with the other sex of the eurygamic, non-autogenous race produced fertile offspring. Crossing the non-autogenous *C. pipiens* with *C. fatigans*, Wied. (which is non-autogenous and stenogamic) was also effected with males of both species, but though some females were fertilised, as proved by the finding of spermatozoa in the receptaculum seminis, and the eggs were matured after a blood-meal, oviposition did not take place. Fertile offspring were produced, however, when the autogenous race of *C. pipiens* was crossed with *C. fatigans*, using males of either. In the F_1 generation, the male hypopygium was intermediate between those of *C. pipiens* and *C. fatigans*.

POGORELY (A. I.). **Zur Biologie der Zecke** *Dermacentor silvarum* **Olen.** [On the Biology of *D. silvarum*.]—*Z. Parasitenk.* **8** no. 5 pp. 533–537. Berlin, 3rd August 1936.

In view of the importance of equine piroplasmosis in the Ukraine and the fact that in many districts the vector has not been specifically identified, the author carried out investigations on ticks in the district of Belovodsk, where the species found were *Dermacentor silvarum*, Olen., and *Hyalomma volgense*, Sch. & Schl. In the first warm days of spring, adults of *D. silvarum* became numerous on horses and also occurred on cattle, sheep, pigs, dogs and occasionally man. Nymphs were seen in summer on dogs, wolves, and foxes, and in winter on horses. Nymphs and adults of *H. volgense* were numerous in autumn and winter on cattle; nymphs occurred in summer on dogs, wolves, foxes and hedgehogs. From the occurrence of *D. silvarum* on horses, both healthy and suffering from piroplasmosis, the author suspected that it was the vector in this district. In the laboratory, the duration of the egg stage of this tick varied from 10 to 60 days, according to the conditions of the environment, and larvae were able to survive without food for up to 76 days. Unfed adults lived for 5·5 months in winter. The cycle of development was completed in 126–225 days. It was found that both larvae and nymphs would feed on rodents, but not on lizards, sparrows, cranes, cattle or sheep. Larvae also would not feed on hedgehogs or horses.

KOLOMIETZ (J. S.). **Zur Frage der Verbreitung und Lebensweise der Zecke** *Rhipicephalus rossicus* **Yak. und Koh.-Yak. in der Ukraine.** [On the Question of the Distribution and Bionomics of *R. rossicus* in the Ukraine.]—*Z. Parasitenk.* **8** no. 5 pp. 538–541. Berlin, 3rd August 1936.

Rhipicephalus rossicus, Yak. & Kohl-Yak., is widely distributed in southern Ukraine. It occurs on hedgehogs, hares, horses, cattle, dogs, pigs, cats and man. In the summer of 1935, it was numerous on horses suffering from piroplasmosis caused by *Nuttallia*, and no other tick was seen on such horses. In the laboratory, the number of eggs laid by a female ranged from 200 to 6,800, and the life-cycle was completed in 77–108 days.

SCHULZE (P.). **Neue und wenig bekannte Amblyommen und Aponommen aus Afrika, Südamerika, Indien, Borneo und Australien. (Ixodidae.)** [New and little known *Amblyomma* and *Aponomma* from Africa, South America, India, Borneo and Australia.]—*Z. Parasitenk.* **8** no. 6 pp. 619–637, 12 figs., 22 refs. Berlin, 26th September 1936.

WAGNER (J.). **Neue nordamerikanische Floharten** [7 new species and a new subspecies of fleas from U.S.A.]—*Z. Parasitenk.* **8** no. 6 pp. 654–658, 8 figs. Berlin, 26th September 1936.

[VINOGRADSKAYA] WINOGRADSKAJA (O. N.). **Osmotischer Druck der Haemolymphe bei *Anopheles maculipennis messeae* Fall.** [Osmotic Pressure of the Haemolymph in *A. maculipennis messeae*, Flni.]—*Z. Parasitenk.* **8** no. 2 pp. 697–713, 20 refs. Berlin, 26th September 1936. [*Cf. R.A.E.*, B **24** 95.]

PURI (I. M.). **The Distribution of Anopheline Mosquitoes in India: Additional Records, 1931–1935.**—*Rec. Malar. Surv. India.* **6** no. 2 pp. 177–211, 4 pp. refs. Calcutta, June 1936. [*Cf. R.A.E.*, B **21** 240, etc.]

[POKROVSKIĬ (S. V.).] **Покровский (С. В.). Sur la faune des *Aëdes* des Départements de Moscou et de Kalinine.** [*In Russian.*]—*Med. Parasitol.* **5** no. 2 pp. 241–245. Moscow, 1936. (With a Summary in French.)

FINK (D. E.) & HALLER (H. L.). **Relative Toxicity of some optically active and inactive Rotenone Derivatives to Culicine Mosquito Larvae.**—*J. econ. Ent.* **29** no. 3 pp. 594–598, 2 figs., 9 refs. Menasha, Wis., June 1936. [*Cf. R.A.E.*, A **24** 729.]

SEBESS V. ZILAH (G.). **Ueber Heleiden des Balaton-Gebietes.** [A list of 43 species of Ceratopogonids from Lake Balaton district including a new species and a new variety.] [*In Magyar.*]—*Arb. ung. biol. Forsch.-Inst.* **8** pp. 196–206, 4 figs., 17 refs. Tihany, 1936. (With a Summary in German.)

NIESCHULZ (O.). **Die Entwicklungsstadien von *Tabanus rubidus* Wied. und *T. striatus* Fabr.** [Morphology of the Stages of Development of *T. rubidus* and *T. striatus*.]—*Arch. Naturgesch.* (N.F.) **5** no. 2 pp. 230–255, 10 figs., 16 refs. Leipzig, 28th August 1936.

THOMPSON (G. B.). **Some additional Records of an Association between Hippoboscidae and Mallophaga, together with a Bibliography of the previous Records.**—*Ann. Mag. nat. Hist.* (10) **18** no. 104 pp. 309–312. London, August 1936. [*Cf. R.A.E.*, B **21** 269; **23** 228.]

ROTHSCHILD (M.). **Siphonaptera from Western Australia** [including a new genus, 4 new species and a new subspecies].—*Novit. zool.* **40** no. 1 pp. 3–16, 19 figs. Tring, 25th August 1936.

JORDAN (K.). **Dr. Karl Jordan's Expedition to South-West Africa and Angola: Siphonaptera** [including 2 new genera, 2 new species and a new subspecies].—*Novit. zool.* **40** no. 1 pp. 82–94, 6 figs. Tring, 25th August 1936.

Construction and Placing of Pupae Shelters on Lake Victoria Nyanza.—*Rep. med. Dep. Uganda 1935* p. 68. Entebbe, 1936.

Details are given for the construction of shelters under which tsetse flies [*Glossina*] are attracted for larviposition. Frames are made of poles, reeds and saplings and thatched on top and at the upper part of the sides with grass. Loam and sand are then heaped up in the shelter to a depth of 8–12 ins. The thatch must be thick enough to prevent the loam from being damped by rain, as otherwise no larvae will be deposited. Banana fibre is suspended from the roof in rows 6 ins. apart and 6–12 ins. from the surface of the sand and loam. The slanting roof faces the direction of the prevailing wind and so prevents the access of rain. In all the shelters in use in Uganda, the slanting roofs face the open lake (Lake Victoria) and the entrances face the forest or bush. All undergrowth is cleared for a distance of 8–10 ft. round the shelters and, except when the shelters are placed behind papyrus, a clearing some 15 ft. wide extends down to the lake shore. It has been found that when there is a considerable stretch of papyrus between a shelter and the lake no larvae are deposited. Some of the traps are made useless by the rising of the lake, which makes them too damp.

[Hargreaves (H.).] **Annual Report of the Government Entomologist for 1935.**—*Rep. med. Dep. Uganda 1935* pp. 69–73. Entebbe, 1936.

It has been found that "cotton-seed tar" (a by-product of producer-gas engine plants using cotton-seed as a source of gas) mixes readily with kerosene. A mixture of one volume of the latter with three of the former, after being strained through mosquito gauze, passed freely through a sprayer without choking the jets and when applied to water spread evenly without forming globules. Tests of the value of this mixture in comparison with the anti-malarial oil at present used were carried out against larvae of *Anopheles gambiae*, Giles, in pits, using $\frac{3}{4}$ fl. oz. to 14 sq. ft. The experiments showed no significant difference in favour of either, but "cotton-seed tar" is available locally in considerable quantities and the cost of the mixture is approximately half the local cost of the anti-malarial oil.

In tests of a mucilaginous infusion of the leaves of *Opuntia* for the control of mosquito larvae [*cf. R.A.E.*, B **24** 217], it was found that the lethal effect was of a mechanical nature, the infusion without the mucilage being ineffective. In view of the comparative rarity of the plant in Uganda and of the satisfactory results obtained from the application of grass to the breeding waters [*cf.* **22** 83], the use of prickly pear is not advocated where a plentiful supply of grass or similar herbaceous material is available. From experiments in which suspensions of fruits of *Balanites aegyptiaca* in water were tested against mosquito larvae, it is concluded that the berries are toxic at certain concentrations, but as they had become dry at the time the tests were made, further experiments should be made with berries as fresh as possible.

Hungry adult females of *Anopheles funestus*, Giles, the smallest dangerous mosquito in Uganda, failed to pass through wire gauze with a mesh 14 × 14, 30 S.W.G. (196 holes per sq. inch.) or of a 27/28 mesh (trade count) cotton netting. It appears that the length of the

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legs and not the size of the body prevents mosquitos from passing through small holes. It is therefore concluded that there is no danger from mosquitos in using either the wider meshed cotton netting (25/26 mesh (trade count) woven of 30 or 40/60 counts cotton) recently introduced to supersede a netting of considerably smaller mesh, or the wire gauze tested, which is cheaper and excludes less air than the one at present employed in Entebbe, which has a smaller mesh.

Among the breeding places of dangerous species of Anophelines discovered on the outskirts of Kampala, depressions round mounds on which sweet potatoes were grown on low-lying ground proved to be important during wet weather.

A tsetse-fly survey of the proposed route for the new road from Fort Portal to Bundibugyo in Bwamba (over 40 miles away) was carried out during September–October under dry season conditions. *Glossina palpalis*, R.-D., was found at several places, but only in the forest section. In view of the effect of weather on the dispersal of the fly and of the connection by road with an area infected with sleeping sickness, it was proposed that a further survey should be made in the wet season.

Tests were carried out with a spray consisting of a solution of 1½ lb. paradichlorobenzene in 1 gal. kerosene against *Ornithodorus* [*moubata*, Murr.]. The results were promising, but not absolutely conclusive, owing to the impossibility of careful supervision and to suspected re-infestation of the premises used in the final experiment.

HESTER (E. C.) & CUNNINGHAM (B.). **The Effects of Endocrines on the Developmental Rates of Flesh Flies.**—*J. Elisha Mitchell sci. Soc.* **52** no. 1 pp. 38–50, 3 refs. Chapel Hill, N.C., July 1936.

The following is substantially the authors' summary of experiments carried out with *Phormia regina*, Mg., to determine what effect feeding on thyroid has on the rate of development, at ordinary and reduced temperatures, whether a cumulative effect is transmitted from one generation to another, and what effect feeding on anterior pituitary has on the rate of development. At room temperatures the length of larval and pupal life was not modified by thyroid feeding as compared to beef feeding, but the time between emergence and oviposition was shortened. At 20°C. [68°F.] both larval and pupal life were lengthened as compared with the controls. In these conditions also the time required for reaching sexual maturity was shortened. At temperatures ranging from 11 to 20°C. [51·8–68°F.] pituitary feeding shortened the length of both larval and pupal life as compared to controls, but caused no apparent difference in the time required to reach sexual maturity after emergence. There were no cumulative effects observed during some 23 generations, but sterility appeared rather suddenly in the 21st and 22nd generations of the insects fed on thyroid.

PICADO (C.). **Sur le principe bactéricide des larves des mouches. (Myiases des plaies et myiases des fruits.)**—*Bull. biol.* **69** no. 4 pp. 409–438, 3 figs., 21 refs. Paris, 1935. [Recd. September 1936.]

The author discusses the methods of feeding of various Dipterous larvae, with particular reference to that of maggots used in the treatment of wounds. He reviews the work of others on the nature of the

bactericidal principle secreted by the maggots [*cf. R.A.E.*, B **23** 57; **24** 26, 184, etc.] and gives a detailed account of his own investigations on the subject.

From experiments with fruit-flies of the genus *Anastrepha* he concludes that the adults do not harbour bacterial symbionts on emergence, but that in the course of feeding they become contaminated with the common bacteria that are found widely distributed in nature. These are introduced into the host-fruits at the time of oviposition; and are transported by the larvae when boring their holes. Their multiplication is, however, checked by the formation in the digestive tract of the larvae of bactericidal alkaline salts formed from acid in the fruit and bases in the larval intestine.

From experiments with other types of Dipterous larvae it was found that the filtrate obtained from crushed larvae of *Musca domestica*, L., whether used in the active state or after inactivation by heat, had no bactericidal effect on *Staphylococcus*. Filtrates obtained from the crushed intestines or body walls of *Dermatobia hominis*, Say (*cyaniventris*, Macq.) showed bactericidal action on *Staphylococcus* from man or cattle, but not on bacilli isolated from the intestine of the larva. When larvae of *Phormia regina*, Mg., were fed on jellified horse serum or gelose with blood, either with or without *Staphylococcus*, the filtrate obtained had no bactericidal effect on *Staphylococcus*, but when they were fed on decaying beef for three days before transfer to gelose with blood for 48 hours, the filtrate proved to be bactericidal. Thus the bactericidal substance depends for its production more on the quality of the nourishment absorbed than on the presence or absence of any particular species of bacteria; even the addition of *Staphylococcus* to an unsuitable medium does not bring about the formation of substances bactericidal for itself. When larvae of *Lucilia eximia*, Wied., were reared without previous disinfection on jellified horse serum or gelose with blood and transferred every two days to fresh culture tubes, the filtrate obtained at the end of five days was not bactericidal for *Staphylococcus*. Thus the bacteria carried by flies in nature are also incapable of producing, in larvae of *Lucilia*, the bactericidal substance in an inadequate medium. When fresh beef juice was added to the media on which larvae of a species of *Sarcophaga* were reared, the larvae died and no bactericidal principle was evolved, whereas when the beef juice was omitted the larvae lived and the bactericidal substance was produced.

The principal difference between the larvae of *Lucilia* and *Sarcophaga* is that the eggs of the former are generally contaminated only by gram-positive cocci and gram-negative bacilli and, if the larvae are reared in sterile serum in which anaerobic bacteria (and the peptones and alkaline soaps that they produce in putrefying meat) are absent, no bactericidal substances are elaborated, whereas, if they are reared on putrefying meat, in which these anaerobic bacteria are abundant, the bactericidal principle is present. On the other hand, the larvae of *Sarcophaga* contain suitable bacteria from birth, so that the bactericidal principle is elaborated by them even in artificial serum media.

An account is given of experiments made to determine the nature of the bactericidal principle.

The following is taken from the author's conclusions: The bactericidal substance does not pre-exist in the larvae causing myiasis, but is elaborated in their intestines when the food medium is suitable. The bacterial flora present in decaying meat plays a preponderating part

in its production. Larvae infesting fruit also elaborate in their intestines substances bactericidal to *Staphylococcus* so long as the fruit is acid. In certain acid fruits the juice, containing peptones and chlorides, gives, by neutralisation with sodium or calcium carbonate, salts bactericidal for *Staphylococcus*. Certain bacteria causing carcass putrefaction, cultivated in carbonated broth, to which was added either lactose or glycogen, give thermostable, non-specific, bactericidal salts. Thus the bactericidal substances found in the intestines are composed of a mixture of sodium and calcium salts in the alkaline part of the digestive tract, where the acids introduced with the food are neutralised.

BARANOFF (N.). **Studien an pathogenen und parasitischen Insekten IV.** *Simulium (Danubiosimulium) columbaczense* **Schönb. en Yugoslavie.** [*In French.*]—37 pp., 2 figs., 7 pls., 3 graphs, 3 maps. Zagreb, Inst. Hyg. u. Sch. Volksgesundh., 1936.

The history of the work done in Jugoslavia on *Simulium columbaczense*, Schönb., is outlined, and an account is given of observations and investigations during the outbreak of 1934, when thousands of domestic animals were killed [*R.A.E.*, B **24** 275, etc.], and, briefly, of the occurrence of this Simuliid in 1935, when it is estimated to have been from 7,000 to 8,000 times less numerous and no losses were reported. Its close association with the Danube at the Iron Gate is evidenced by its inability to develop normally in other waters in the same geographical area. The favourable abiotic factors during adult emergence are high air and water temperatures, a regular fall in the Danube water level and the absence of rain. Other favourable factors appear to be the absence of strong winds ruffling the water and thus destroying newly emerged adults, and a decrease in atmospheric pressure, which, like a fall in water level, diminishes the hydraulic pressure on the pupae. Of the special characters of the larvae and pupae of this Simuliid, on the basis of which the author erected for it the subgenus *Danubiosimulium* [**23** 276], the 10 pupal respiratory filaments with ramifications should facilitate breathing in the muddy water. The front of the pupal case is raised, which would lift the pupa above the sediment likely to impede breathing and emergence. The shape of the larvae should protect them against the effects of a swift current, and their strong mandibles should enable them to scrape food off the bottom. In addition to other natural enemies [**22** 204], the sturgeon (*Acipenser ruthenus*) feeds on the larvae.

GIBBINS (E. G.). **Congo Simuliidae.**—*Ann. trop. Med. Parasit.* **30** no. 2 pp. 133–150, 10 figs., 14 refs. Liverpool, 17th July 1936.

An examination of collections of Simuliids from the Belgian Congo revealed the presence there of 17 different species, including two new ones, *Simulium bequaerti* and *S. hissetteum*, which are described. *S. violaceum*, Pom., which was originally described as a variety of *S. alcocki*, Pom. [*R.A.E.*, B **10** 106] is raised to specific rank, and descriptions are given of the terminalia of both sexes of these two species and *S. nigritarsis*, Coq. [*cf.* **18** 239; **22** 211]. The pupae of the five species are described; the author points out that the descriptions of the external characters of the adult should be taken with caution as the specimens were preserved in spirit and much of the pubescence was lost. The distribution of all 17 species in the Belgian Congo is given.

Patton (W. S.). **Studies on the Higher Diptera of Medical and Veterinary Importance. A Revision of the Species of the Genus *Glossina* Wiedemann based on a Comparative Study of the Male and Female Terminalia.** –*Ann. trop. Med. Parasit.* **30** no. 2 pp. 151–168, 23 figs. Liverpool, 17th July 1936.

This paper, which is a continuation of a previous one [*R.A.E.*, B **24** 171], deals in the same manner with *Glossina medicorum*, Aust., *G. haningtoni*, Newst. & Evans, *G. schwetzi*, Newst. & Evans, *G. severini*, Newst., *G. morsitans*, Westw., *G. morsitans* var. *submorsitans*, Newst., and *G. swynnertoni*, Aust.

Blacklock (D. B.). **Studies in Rural Hygiene in the Tropics. II.—The Cultivation of Dense Shade Plants as an Anti-malaria Measure.** —*Ann. trop. Med. Parasit.* **30** no. 2 pp. 181–186, 1 pl., 1 ref. Liverpool, 17th July 1936.

The author discusses the reasons why drainage as a measure for the control of Anophelines and malaria, which has been so successfully applied in Malaya, has not proved satisfactory in Assam, and points out that in certain parts of Assam the failure may be attributable to a lack of adequate fall in the tributaries of the large rivers into which the local drains are led and in the large rivers themselves. He records personal observations made during a tour in Assam on the successful results obtained by growing dense shade plants over streams and in marshy areas for the control of *Anopheles minimus*, Theo., and suggests that the question of using this method for the control of other species of Anophelines in Africa and elsewhere would be worth investigating.

Corson (J. F.). **The Influence of Repeated Transmissions in Animals on the Virulence of *Trypanosoma rhodesiense* and *Trypanosoma brucei*.** —*Ann. trop. Med. Parasit.* **30** no. 2 pp. 211–220, 10 refs. Liverpool, 17th July 1936.

The following is the author's summary: The influence on polymorphic trypanosomes of maintenance by direct passages, as used in laboratories where tsetse flies could not be obtained, is discussed, and it is suggested that little is known about the subject. Records of transmissions of several recent strains of *Trypanosoma rhodesiense* and *T. brucei* are given in a table, the duration of life after infection being regarded as a rough measure of the virulence of the trypanosomes.

de Buen (S.). **Algunas observaciones sobre el comportamiento del *Treponema hispanicum* en el *Ornithodorus erraticus*.**—*Rev. Sanid. Hig. publ.* **10** (ii) pp. 97–120, 193–212, 2 figs., 36 refs. Madrid, 1935. [Recd. October 1936.]

In previous investigations, the author found that when *Ornithodorus erraticus*, Lucas, had fed on a case of relapsing fever due to *Spirochaeta* (*Treponema*) *hispanica*, the spirochaetes disappeared from the intestine of the tick on the 6th–8th day and appeared in the body cavity on the 7th–10th day. Spirochaetes were found in some suspensions of whole ticks on the 10th and 15th days after the infecting feed, but not in others on the 5th, 10th, 25th and 30th days. Infection was produced by inoculation of suspensions of whole ticks up to the 30th day. Later

it was found that ticks starved after the infecting feed were infective for up to three months [*cf. R.A.E.*, B **19** 18].

In the present paper a detailed account is given of further experiments on the behaviour of *S. hispanica* in *O. erraticus*. The following is taken from the author's conclusions: Of more than 50 females examined, only 7 harboured visible spirochaetes in their genitalia (in 6 cases between the 8th and 21st day after the infecting feed and in 1 case on the 86th day). When the period between the infecting feed and oviposition was 86 days or more, spirochaetes were visible in nearly all the eggs of ticks that had taken a second feed on a healthy animal. The spirochaetes were seen throughout the development of the eggs and in the larvae derived from them. They were more difficult to find in the resulting nymphs and were seen in only 76 per cent. In adults infected by biting, spirochaetes were found in 100 per cent. during the first few days after the infecting feed, in 60 per cent. between the 11th and 50th day, and much less frequently after that time; the total percentage of positive results was 51. They were very frequently seen in the digestive tract up to the 38th day, later they were seen there less often, although they were observed occasionally up to the 150th day. In 31 observations none was found in the Malpighian tubes. They were seen in the body cavity on the 18th, 21st, 40th and 86th days. The salivary glands were positive in 17 out of 91 observations. In a small number of observations on the male genitalia, the results were negative.

In a study of the morphology of the spirochaete in all stages of its development in the tick, the author observed no phenomenon indicating that there was a life-cycle other than reproduction by division of visible forms. A mouse was infected by inoculating 56 eggs from an infected batch. There appears to be a relation between the number of larvae that bite and their ability to transmit the disease. Infection was produced by the bites of as few as two nymphs. The infectiveness of the progeny of a tick undoubtedly depends on the interval between the infecting feed and oviposition. A single adult may transmit the disease by biting, even when removed before excreting its coxal fluid. Fatal infections in mice were more often produced by ticks biting up to 50 days after their infecting feed, when the spirochaetes were still in the stomach; later positive infections were less often fatal and usually occurred when spirochaetes were to be seen in the salivary glands.

The results suggest the possibility of the existence in spirochaetes in the tick of a first phase that produces high and rapid mortality in mice and is localised in the stomach of the tick, and a second that gives rise to a normal infection and is found most frequently in the salivary glands. The fact that they are not found in all nymphs and in all adults may be due to the smallness of their numbers at certain times in the cycle, or to the existence of an invisible phase.

Fontoura de Sequeira (L. A.). **Quelques considérations sur un cas de fièvre exanthématique de la Guinée portugaise.**—*Rev. Méd. Hyg. trop.* **28** no. 4 pp. 210–217, 2 figs., 1 ref. Paris, 1936.

The author points out that it was Firminio Santana who first described the form of exanthematic typhus transmitted by ticks and subsequently called tick-bite fever [*cf. R.A.E.*, B **23** 262, etc.]. He quotes in full that part of the Report of the Health Services of the Province of Mozambique for 1908 in which the observations were published.

He describes in detail a disease from which he suffered in Portuguese Guinea in July 1932 after camping in June in a locality in which ticks (chiefly *Rhipicephalus sanguineus*, Latr.) were abundant. Examination of clothes and skin failed to reveal any Arthropod, but a papule covered with a soft black crust appeared in the right armpit. He diagnosed the disease as tick-bite fever. In October, in another locality, irritating lesions similar to those experienced in June appeared after each excursion into the bush, and on one occasion a minute pink mite was observed in the centre of a papule and two similar mites were obtained from the stems of grasses in the bush. He is convinced that this mite, which has not yet been identified, is the vector of the disease from which he suffered in July.

Roubaud (E.). **The Biothermic Method of Fly Destruction and the Ease with which it can be adapted to Rural Conditions.**—*Quart. Bull. Hlth Org. L.o.N.* **5** no. 2 pp. 214–218. Geneva, June 1936.

The author discusses the disadvantages of various methods that have been advocated to prevent flies (particularly the house-fly [*Musca domestica*, L.] and *Stomoxys* [*calcitrans*, L.]) from breeding in manure [*cf. R.A.E.*, B **22** 231 ; **24** 44], as determined by experiments carried out under rural conditions in France. If cow dung, which is generally avoided by *M. domestica*, is used to cover horse dung, the latter may ferment sufficiently for the steam to pass through the protective covering, in which case large numbers of eggs may be deposited on the cow dung ; moreover, larvae will develop in this medium. Covering the manure heaps with sacks, tarpaulins, etc., would be satisfactory if the steam given off at high temperature by the fermenting mass did not lead to the rapid deterioration of the cover. There is also the danger that flies may lay large quantities of eggs on those parts of the material that have become so thin or worn that they allow the steam to pass through ; and the method deprives fowls of the larvae, which are one of their most valuable foods. The spreading of manure in thin layers to dry requires a considerable amount of labour, and, if after it has been put back into heaps it is moistened by rain, fermentation begins again and it will once more become favourable for breeding. The biothermic method, in which the fresh manure is placed in a hollow scooped out at the top of a fermenting pile so that the eggs are destroyed by the heat [**4** 23], is considered the only one applicable to rural conditions. More satisfactory results are obtained with this method when the manure is placed in pits with vertical walls, so that no eggs can be laid or larvae develop on the sides of the heap, and the larvae tend to collect at the top where they can be destroyed by birds, particularly fowls [*cf.* **9** 212].

Lörincz (F.) & Makara (G.). **Investigations into the Fly Density in Hungary in the Years 1934 and 1935.**—*Quart. Bull. Hlth Org. L.o.N.* **5** no. 2 pp. 219–227, 2 figs., 5 refs. Geneva, June 1936.

To determine whether there is any relation between the density of the house-fly, *Musca domestica*, L., and the number of registered cases

of typhoid in different parts of Hungary, data on the abundance of flies were collected from villages and towns between 1st May 1934 and 1st May 1935. In each village, catches were made on specially designed fly-papers, which were hung up every second day for 24 hours in kitchens, dwelling rooms where meals were taken, a medical consulting room and the yards of farm houses. Reports were received every month from every catching station, and in order to determine the species of flies caught and to check the accuracy of the counts, one fly-paper was obtained from each station every week. The results of similar work in other countries are briefly reviewed.

In analysing the data, the flies found in rooms were classified separately from those caught in the open. The number of flies caught during the whole year in 29 stations was 1,115,013. Of 21,000 flies caught on 60 papers in different months, 98·5 per cent. were *M. domestica*; most of the remainder were species of *Fannia*. The monthly totals for the 8 villages are shown in a table. The changes in fly density in dwelling rooms, the annual 5-day mean temperatures for 1934 and the epidemiological curve of typhoid fever cases for the same year are plotted on a graph. After a slow increase in spring there is a sudden rise in numbers in the 1st week in July, and during the 2nd week the number of flies per dwelling room amounted to 675 in 24 hours. This average of about 700 flies remained constant until the middle of October. Increases in density, particularly in the autumn, are not due to any one factor, such as a longer duration of life, but depend also on such factors as the colder weather, which causes the flies to seek refuge in dwelling rooms or kitchens. The temperature rises above 16°C. [60·8°F.] in the 3rd week in April and the 5-day mean of 20°C. [68°F.] is reached in the 2nd week in June and is exceeded until the 4th week in August; after this it declines and falls below 16°C. in the 2nd week in October. The fly curve follows the rise in temperature above 16°C. with a lag of 3 weeks. The sudden fall in numbers after the 2nd week in October is roughly parallel to the fall in temperature until the autumn-winter mean is reached. The typhoid curve follows the fly curve with a lag of about 4 weeks, the relation between the fly curve for August–October and the typhoid curve for September–November being particularly marked.

The authors consider that flies may play a part as mechanical carriers of typhoid, but that the seasonal oscillations of the typhoid curve, and its equally constant annual characteristics in Hungary, cannot be ascribed only to flies. This view is confirmed by observations made in 1934 and 1935, in which it was found that village latrines and human faeces exposed in the open are not so frequently visited by house-flies as is commonly supposed [see next paper]. Workers of the Department of Bacteriology have been collaborating in this investigation since 1933. In their experiments typhoid bacilli could be detected for 18 days in flies that had fed on cultures but only for 2–4 days in those that had fed on the faeces of typhoid patients. Bacilli were detected after 8 months in dead flies fed on typhoid cultures and kept at 18 or 8°C. [64·4 or 46·4°F.]. On 12 occasions, about 50 flies were caught in traps in the wards of the typhoid fever section of a hospital, but no bacilli were discovered. They were not detected in 2,500 flies caught in the rooms of country patients suffering from typhoid. In villages human excrement is often mixed with manure and consequently fly larvae may be exposed to infection. The results of certain experiments suggest that infection may be retained through the pupal to the adult stage,

though no bacilli could be detected in flies that emerged from puparia with sterilised surfaces derived from larvae fed on faeces of typhoid patients or on typhoid cultures.

LÖRINCZ (F.), SZAPPANOS (G.) & MAKARA (G.). **On Flies visiting Human Faeces in Hungary.**—*Quart. Bull. Hlth Org. L.o.N.* **5** no. 2 pp. 228–236, 1 fig. Geneva, June 1936.

An investigation was carried out in a country town in Hungary from 8th May to 10th November 1935 to determine to what extent flies feed and breed in human faeces, and what species visit fresh human faeces exposed in the open. In the course of the study described in the preceding paper, only 66·6 per cent. of the flies taken on fly-papers in water-closets (usually built in the dwellings) were *Musca domestica*, L. This species was found in 14·4 per cent. of the closed latrines and in 11·9 per cent. of the open ones. In faeces collected near or far from houses, several species were found breeding, but in no case was *M. domestica* observed. In fly-traps containing human faeces placed in stables, an average of not more than 2–4 examples of this species were found in 24 hours. On two occasions, however, house-flies were bred from human faeces exposed in stables.

An average village house with its outbuildings was selected for the present study and 4 fly-traps were exposed in the yard at different distances from the house for three consecutive days each week, always on the same site. They remained on the site for 24 hours and were baited with human faeces for two days and fruit for one. The numbers of flies of each genus taken in the traps baited with faeces or fruit or reared from faeces for each month are shown in a table. Of the 4,567 examples of *M. domestica* caught, 13·62 per cent. were found on faeces and 86·38 per cent. on fruit. The numbers varied inversely with the distance of the trap from the kitchen, from 232 on faeces and 1,567 on fruit in the trap about 3 yds. from the kitchen to 9 and 174 respectively in the trap about 28 yds. away. Faeces from healthy persons lying near the house are visited by a comparatively large number of flies, whereas those lying further away are much less frequented. These findings suggest that, in Hungary at least, human faeces are not a favoured breeding medium of the house-fly. Moreover, flies were reared from only 2 out of 22 lots of faeces exposed in the open near the house. From August to October two traps baited with faeces and fruit, respectively, were exposed side by side at a distance of about 3 yds. from the kitchen ; several times as many house-flies were caught in the one baited with fruit. Thus the close connection between house-flies and human excrement that is commonly accepted does not appear to exist.

Next to house-flies, Anthomyiids were the most numerous ; they included species of the genus *Fannia*, which are found in dwellings and may play a part in the dissemination of disease. As these flies readily visit both faeces and fruit and breed freely in human faeces, it is suggested that further information should be obtained on the question of their importance. The various other genera and species of flies taken and their possible significance from the point of view of the transmission of disease are briefly discussed. It is concluded that in Hungary house-flies may carry pathogenic organisms, especially if the source of infection is in the house itself or in its immediate surroundings, though not to a considerable degree.

SWELLENGREBEL (N. H.), DE BUCK (A.), KRAAN (M. H.) & VAN DER TORREN (G.). **Occurrence in Fresh Water and Brackish Water of the Larvae of** *A. maculipennis atroparvus* **and** *messeae* **in some Coastal Provinces of the Netherlands.**—*Quart. Bull. Hlth Org. L.o.N.* **5** no. 2 pp. 280–294, 3 diagrs., 2 maps. Geneva, June 1936.

Previous investigations on the races of *Anopheles maculipennis*, Mg., in Holland have shown that adults of *atroparvus*, van Thiel, are most numerous in the coastal provinces, except in South Holland where adults of *messeae*, Flni., predominate. As the salinity of the water in South Holland is on the whole much lower than in the other coastal provinces, it was thought, but not proved, that the larvae of *atroparvus* prefer brackish water and those of *messeae* fresh water. If the breeding of *atroparvus* is not checked by a low salinity of the water, there is no reason to suppose that it will disappear or diminish in numbers when the surface waters of North Holland have become fresh as a result of the impounding of the Zuyder Zee [*cf. R.A.E.*, B **22** 36]. Investigations to determine the relation between the two types of water and the two races of *A. maculipennis* were therefore undertaken during three larval seasons over a wide area comprising South Holland, a fresh water region, non-malarious, where adults of *messeae* had been found to predominate ; North Holland, a region in which the water is mainly brackish and of which a large part is more or less malarious, where adults of *atroparvus* are most abundant ; the delta islands, where the water is more or less brackish and *atroparvus* more or less prevalent ; and the " inland area," including the whole of the Province of Utrecht and parts of North Brabant and Gelderland, where brackish water and malaria are practically absent and adults of *messeae* are prevalent.

As it was necessary to find out where larvae develop to maturity and not where eggs are deposited, the larvae rather than the eggs had to be identified. They were distinguished by means of the type of hair on the sides of the 2nd abdominal segment in conjunction with the number of branches of the antepalmate hairs on the 4th and 5th abdominal segments. From an experiment to test this method of identification, it was concluded that it was sufficiently accurate to warrant its application in the field. It would not, however, be applicable in regions where other races of *A. maculipennis* exist.

From data on the prevalence of larvae of the two races in breeding places graded according to the degree of salinity, it was found that larvae of *atroparvus* are not limited to brackish water (mesohaline water with a chlorine content of 1,000 mg. or more per litre), and that they even breed in fresh water (chlorine content under 100 mg.). However, judging by the numbers of larvae taken in 10 dips, they are 39 times as numerous in brackish water as in fresh and 11 times as numerous as in water with a chlorine content of under 500 mg. On the other hand, larvae of *messeae* in fresh water or in water containing less than 500 mg. chlorine are less than 4 times as numerous as in brackish water, and even when the chlorine content exceeds 2,000 mg. the larval density is still 12·5 per cent. of that in fresh water. Thus the preference of *messeae* for water of low salinity is not so well marked as that of *atroparvus* for water of high salinity. Larvae of *atroparvus* predominate when the chlorine content of the water is 750 mg. or more and those of *messeae* when it is under 500 mg.

A comparison of a map on which the breeding places are marked according to 4 degrees of salinity (over 1,000 mg. chlorine, 500–999 mg., 100–499 mg. and under 100 mg.) with one in which the prevalence of larvae of the two races is shown in 4 classes, *viz.*, decided majority (75 per cent. or over) of *atroparvus*, slight majority of *atroparvus*, slight majority of *messeae*, and decided majority of *messeae*, shows that the areas with a decided majority of *atroparvus* coincide remarkably well even in details with water having a high chlorine content. A number of minor discrepancies are obvious, of which the most conspicuous is the occurrence of a decided majority of *atroparvus* in an area of fresh water along the eastern boundary of the " inland area." Such discrepancies were usually noticed in areas where fresh water is close to or within brackish water regions where *atroparvus* is prevalent. It seems possible that larvae of *atroparvus* can occupy breeding places that are uncongenial and suppress larvae of *messeae*, provided that they are supported by a vast majority of their own kind in the surrounding or adjacent breeding area. In cases where larvae of *messeae* were found in brackish water, conditions never suggested that they had been crowding out those of *atroparvus*. The possibility of an antagonism between the two races should be further studied in view of its practical importance in the Netherlands. The hope that Anopheline conditions in North Holland will come to resemble those in South Holland may be frustrated or deferred if the numbers of *atroparvus* cannot be reduced unless larvae of *messeae* occupy the breeding places in which the water has become fresh.

SWELLENGREBEL (N. H.), DE BUCK (A.), SCHOUTE (E.) & KRAAN (M. H.). **Investigations on the Transmission of Malaria in some Villages north of Amsterdam.**—*Quart. Bull. Hlth Org. L.o.N.* **5** no. 2 pp. 295–352, 3 figs., 5 maps, 2 diagrs. Geneva, June 1936.

From previous investigations on the races of *Anopheles maculipennis*, Mg., in Holland, it was concluded that malaria transmission is limited to the autumn [*cf. R.A.E.*, B **10** 20, 113; **18** 52] so that *messeae*, Flni., can play no part and *atroparvus*, van Thiel, is the only vector; that, although the latter does not breed solely in brackish water, no intensive breeding takes place elsewhere [*cf.* preceding paper]; and that the transformation of the brackish water area in the province of North Holland would be practically equivalent to " species sanitation " [*cf.* **22** 36, 202]. This theory of control is based on the exclusively autumnal transmission of malaria, but van Thiel has recently collected data suggesting that malaria in Holland may be acquired in July or August [*cf.* **23** 225]. Although cases of summer transmission are known to occur, the authors contend that the risk of infection in summer is negligible when compared with that later in the year. To prove their contention, they carried out the detailed investigations here described.

From September to February the numbers of Anophelines in houses were practically unlimited, but from February to August they were much lower. Infected individuals were found throughout the year except in the second half of May and in June, but between 1st January and 16th August only three contained normal sporozoites (one in January, one in July and one in the first half of August). The first large increase in the number of infections occurred in the second half of August, and the maximum numbers were reached in the second half

of October and in November. Degeneration of oöcysts began in the second half of October and all had degenerated by the second half of December; degeneration of sporozoites began in the first half of November and only degenerated ones were seen in the second half of January. Oöcysts required a fortnight to mature before November, but after that time they took longer. Fresh infections were only found in mosquitos up to the end of October (although they continued to mature till the end of November), so that the period during which houses should be sprayed for mosquito control need not be longer than from 16th August to 1st November.

The fact that Anopheline infection was firmly established in the second half of August might suggest that it is not autumnal, but from the sharp decrease in the number of Anophelines containing developing ova that occur at this time, it was clear that semi-hibernation in *atroparvus* had already begun. In former years, this decrease had not been observed so early, probably because the Anophelines were caught in animal shelters, where the percentage containing developing ova still remained as high as 63 in 1935, although that in houses had dropped to 15. The fact that females are carrying mature ova does not incite them to leave their shelters, for such females could be found in a few houses in November and December, and, contrary to observations made in summer, their rate of infection was not lower than that of others. It is now known that *atroparvus* develops fat-body in the period of semi-hibernation, although the quantity is not so great as in *messeae*. The first well-developed fat-body was found in *atroparvus* on 30th July, but it was not until the second half of August that it was seen in 25 per cent. of the females dissected. The percentage of infection in 163 females with a well developed fat-body was 15, as compared with 3 in 110 females with developing eggs and 2 in 374 that contained neither fat-body nor eggs, thus showing that it is the sexually inactive individuals that initiate autumnal infection. The percentage of engorged females was lowest from the second half of November to the second half of February, reached a maximum in May–July, remained fairly constant at a low level in August and September and decreased in October and November. Practically all the blood found in these mosquitos was that of man, not only in the autumn but also in the summer; this is probably due to the lack of sufficient stabular deviation in the villages under observation.

Hibernation in *messeae* began in the second half of August, and the last female with blood in its stomach was caught on 6th August. The only infected female out of 1,223 *messeae* dissected was taken on 20th March 1935, and as the sporozoites were degenerated, it had probably acquired the infection in the previous summer. Examples of *messeae* were apparently very rare in the early summer; they began to appear in the late summer and were fairly numerous in autumn and winter, but it is unlikely that they played any part in the transmission of malaria, as they never contained blood. In one house, two females with mature eggs were found in November and December, respectively, but it is not known whether they had fed during the autumn or whether they were stragglers from the pre-hibernating generation.

There were few animal shelters in the villages examined. The live-stock consisted chiefly of rabbits kept near the houses in hutches, in which Anophelines were found only in summer. Infected mosquitos were few, but the results of an examination of the stages of development of the parasites in mosquitos taken in houses and rabbit hutches in July,

in the second half of August, and in September support the hypothesis that Anophelines infected in houses in the summer do not remain there for more than a few days, and it is only by chance that they return there later, when their salivary glands have been invaded. They are more likely to enter rabbit hutches. In the second half of August, however, when the production of eggs decreases, they are more likely to be found in houses where they have acquired infection. Later still, when egg-production has ceased, infected individuals are unlikely to be found in animal shelters. The authors believe that stabular deviation is insufficient to account for the small number of infected Anophelines found in houses in the summer, and consider that this is more easily explained by James' hypothesis that there is a real scarcity of females at this time because of the dangers to which they are exposed during the maturation and deposition of eggs [*cf.* **18** 32]. Moreover, the paucity of animal shelters (such as pig-sties) that exercise a strong stabular deviation should have resulted in the finding of a large number of infected females in houses, if a large number had really been present.

Anophelines that acquire their infection in the house where they are caught usually show a variety of oöcysts of all stages, whereas Anophelines infected elsewhere usually harbour sporozoites only. There is little chance of finding locally acquired infections in mosquitos in houses occupied by a few adults without young children. Observations showed that infected Anophelines rarely stray from the focus of infection and the radius of dispersal is small, but dispersion must take place or infection would remain localised in one house, for mosquitos migrating in summer are rarely infected, and may in any case seek shelter in rabbit hutches. In only a few instances was the finding of stray infected mosquitos in a house followed by cases of malaria in the following year.

Mosquitos became infected from what are termed "healthy carriers" (persons who have malaria parasites in their blood but feel healthy and do not receive treatment), and these persons are of more importance as a source of infection than malaria patients. As all Anopheline infection has degenerated by January, the mosquitos must be infected afresh every autumn, and the healthy carriers bridge the gap between December and August. The necessity for treating these individuals is pointed out.

Spraying against mosquitos in houses cannot be left to the individual householder, for many of the houses afford inaccessible shelters for enormous numbers of mosquitos and the only effective way of reaching such places is by means of a sprayer worked by compressed air or liquid carbon dioxide. Moreover, as the spraying operation is expensive, requires local organisation and trained personnel, and must be carried out once a fortnight from 16th August to 1st November, it is important that the number of houses to be treated should be as small as possible. Various criteria were tested by which houses to be sprayed may be selected without dissecting Anophelines to find infection, and it was concluded that the most reliable is the number of young children present. By using the criterion "four or more young children under 16 years of age," the number of houses to be sprayed is reduced to about a third and about 94 per cent. of the infected Anophelines are destroyed. In further similar observations in another locality, it was found necessary to change this criterion to "three or more young children under 16." In one village, data were obtained on the families and homes of children, divided into two groups according to which of two schools

they attended. For one group, the incidence of malaria in the families, the spleen rate in the children, and the rate of Anopheline infection in the houses in which infected mosquitos were found were half what they were for the other. Children belonging to the former group, who lived in homes with an average of 5·7 inhabitants including 2·8 children, were affected by malaria, but not to an extent sufficient to cause chronic infections. Those belonging to the second group, who lived in homes with an average of 7·5 inhabitants including 4·5 children, under overcrowded conditions in varying degrees of poverty and squalor, were not only suffering twice as much from malaria, but the infections were often of the chronic type entailing splenic enlargement in 48 per cent. Eight-ninths of the healthy carriers occurred in this group. The distribution of malaria is focal, but the foci in this case are not determined by the distance from Anopheline breeding places but by the conditions in which certain families live.

In the villages examined, there were large numbers of infected Anophelines and endemic malaria of considerable intensity, both confined to a few houses. Re-infection, which must have been frequent, tends to establish a condition of tolerance to malarial infection leading to a state of equilibrium. If some unusual condition should cause the dispersal of the numerous infected Anophelines, the effect would be serious. It seems possible that the periodically recurring epidemics of malaria in Holland may be due to some factor that effectively disperses them.

DIEMER (J. H.) & VAN THIEL (P. H.). **Remarks with regard to the " Courte instruction pour la détermination des variétés d'*Anopheles maculipennis* " by the Malaria Committee of the League of Nations.**—*Proc. Acad. Sci. Amst.* **39** no. 1 pp. 109–117, 3 figs., 17 refs. Amsterdam, January 1936. [Recd. September 1936.]

The authors discuss the significance of the distribution of the races (biotypes) of *Anopheles maculipennis*, Mg., as shown by the maps published in " A brief Guide to the Varieties of *Anopheles maculipennis* " [*R.A.E.*, B **23** 152] in connection with the theory of " geobiotype circles " [*cf.* **23** 269]. Biotypes that live mainly in adjacent areas separated by climatic factors, but do not replace each other in different environments, are known as geobiotypes and form geobiotype circles. As *labranchiae*, Flni., *atroparvus*, van Thiel, and *Anopheles sacharovi*, Favr. (*elutus*, Edw.) replace one another in different climatic regions and the progeny of their crosses is largely fertile, they are regarded as forming one geobiotype circle. Provided that the assumption that *messeae*, Flni., of northern Europe is not found in southern Italy is correct, then *messeae* and *melanoon*, Hackett, also form a geobiotype circle. The typical form of *A. maculipennis*, Mg., is widely distributed over almost the whole area covered by the other biotypes and is not included in a geobiotype circle. The nomenclature of the type form and of *messeae* is discussed.

DE BUCK (A.). **Degenerated Cysts and Black Spores in *Anopheles* infected with Benign Tertian Malaria.**—*Proc. Acad. Sci. Amst.* **39** no. 4 pp. 559–563, 1 fldg. pl., 4 refs. Amsterdam, April 1936. [Recd. September 1936.]

The author discusses the nature of the typical banana-shaped " black spores " observed in examples of *Anopheles maculipennis*, Mg.,

infected with the parasites of benign tertian malaria [*Plasmodium vivax*] and of other bodies with which they may be confused [*cf.* *R.A.E.*, B **21** 77]. Since typical banana-shaped black spores were never seen in laboratory-bred uninfected mosquitos, he disagrees with Mayne [**17** 254] that they are unrelated to malaria parasites. Moreover, as they were never found in mosquitos before the oöcysts had reached maturity, he considers that they are probably degenerated sporozoites. The black spores lying free outside the oöcysts would appear to have been sporozoites that had been transformed after they had been expelled from ripe and ruptured oöcysts. The typical black spores are found as frequently in the salivary glands as in the stomach ; they are never found in the cells of the glands but only on the coelomic surface. The small black spores found adhering to the centre of some degenerated oöcysts may be a stage in the development of the sporozoites into typical black spores.

RANKOV (M.). **Ueber die Malariakurven am Balkan.** [On Malaria Curves in the Balkans.]—*Arch. Schiffs- u. Tropenhyg.* **40** no. 9 pp. 373–381, 7 graphs, 43 refs. Leipzig, September 1936.

Curves are given showing the annual course of the various forms of malaria in southern Serbia, as observed in 8 stations from 1928 to 1932. The peaks of infection with *Plasmodium vivax*, *P. falciparum* and *P. malariae* occur in late summer and autumn and are due to new infections by Anophelines, but a smaller peak of *P. vivax* in spring cannot be associated with Anopheline transmission and is mainly due to relapses, which occur in spring and even in winter [*cf. R.A.E.*, B **18** 52].

ECKSTEIN (F.). **Experimentelle Beobachtungen an** *Anopheles maculipennis*. [Experimental Observations on *A. maculipennis*.]—*Arch. Schiffs- u. Tropenhyg.* **40** no. 9 pp. 381–395, 27 refs. Leipzig, September 1936.

The factors affecting the geographical and local distribution of the races *atroparvus*, van Thiel, and *messeae*, Flni., of *Anopheles maculipennis*, Mg., are obscure. Investigations with salt solutions here described confirmed Corradetti's finding that larvae of *atroparvus* support a higher salinity than those of *messeae* [*R.A.E.*, B **22** 137]. Solutions of common salt at a concentration of 0·5 per mille allowed 95 per cent. of young larvae of *messeae* and 96 per cent. of those of *atroparvus* to survive. At higher concentrations, mortality increased rapidly with *messeae* and gradually with *atroparvus*, until, at 10 per mille, no larvae of *messeae* survived and only 13 per cent. of *atroparvus*. In an artificial sea-salt solution, 3·5 and 6 per cent. of *atroparvus* survived at concentrations of 1·19 and 0·77 per cent. respectively, whereas no larvae of *messeae* survived at either concentration. Other experiments gave analogous results.

It was noticed that the young larvae moved with greater difficulty in salt solutions than in fresh water, this being more marked with *messeae* than with *atroparvus*. As this difficulty was less apparent at a depth than at the surface, experiments were made to ascertain how far foreign matter at the surface affects Anopheline larvae. Talc, spores of *Lycopodium* and maize pollen were dusted on the water. Equal numbers of *messeae* and *atroparvus* were used in each experiment, the final survivors of the series of tests being 247 *atroparvus* and 10 *messeae*.

It is therefore concluded that the local and perhaps also the geographical distribution of the two races can be referred to the different surface characters of fresh and saline water. Surface contamination had no influence on oviposition by the two races, thus confirming observations of the eggs of both occurring in the same pools. If the particles on the water surface are sufficiently minute, they exclude the larvae from the surface. If a breeding place is covered with particles the surface of each of which is smaller than 0·09 sq. mm., the interstices are too small to allow the larvae to find space for their spiracles unless they are able to push aside the particles. This requires a force superior to the adhesion between them. When using dusts against Anopheline larvae, the size of the particles is important and particles of an inert dust may cause death if under a certain size. It has not been possible to ascertain with sufficient certainty differences in the diameter of the spiracles of the two races, but further investigation is being directed to find whether the spiracles of *atroparvus* are at a different angle to the surface of the water than those of *messeae*, or whether, as appears to be the case, the larvae of *atroparvus* are more mobile and so less exposed to surface contamination.

de Buck (A.). **Some Results of Six Years' Mosquito Infection Work.**—*Amer. J. Hyg.* **24** no. 1 pp. 1–18, 8 refs. Baltimore, Md, July 1936.

The method of inducing malaria by the bites of Anophelines has been used by the malaria therapy service in Amsterdam since August 1929. Notes are given on the technique of keeping and feeding the mosquitos ; it has not been found necessary to employ such an elaborate one as that described by Boyd and Stratman-Thomas in a paper already noticed [*R.A.E.*, B **21** 73], a fact that may be partly explained by differences in climatic conditions.

Two strains of *Plasmodium vivax* were used, one from Holland and the other from Madagascar. Of 85 persons inoculated with the former, 36 failed to develop malaria, whereas of 159 persons inoculated with the latter, 150 became infected. In the successful cases the average number of infected mosquitos used was 13 ; in 19 of them it was 1–3. The normal incubation period in man would appear to be not more than 30 days, and failure to develop malaria within that period indicates either that no infection has taken place or that the infection has become latent and will not give rise to an attack until 6 months or more after the inoculation. It was found that protracted incubation cannot always be avoided by repeated feedings of a large number of infected mosquitos [*cf.* **18** 52], though the number of bites may have some influence. In view of the large numbers of mosquitos used, it seems unlikely that the negative results can be explained by their failure to inject sporozoites in spite of their having infected glands [*cf.* **19** 118]. It is suggested that the tendency to produce infections with a protracted incubation period is the principal cause of the negative results, and that degeneration of the sporozoites, which may begin as early as one month after infection of the glands, is another. Moreover, it is undoubtedly true that the infecting power of sporozoites that appear quite normal may have been lost or impaired. Partial degeneration of the sporozoites, as well as depletion of the salivary glands, may play some part in lengthening the incubation period, a phenomenon sometimes observed when using old batches of mosquitos.

The importance of the density of gametocytes is discussed. The author does not agree with the view that 100 oöcysts per stomach may be detrimental to the mosquito [*cf.* **21** 73; **24** 222]. He has obtained little evidence that blood giving a high gametocyte count has ill effects on the mosquito, although weak individuals may be unable to survive an infection of 300–400 oöcysts. On the other hand, heavy infections may be harmful to the oöcysts themselves; the heavier the infection, the greater the proportion of oöcysts that do not reach maturity. After only one feed on a suitable case, 100 per cent. of the females of *Anopheles maculipennis* var *atroparvus*, van Thiel, are generally infected, whereas in var. *messeae*, Flni., the percentage may be much less. This difference between the two races, however, occurs only in the hibernating generations and may be related to protracted digestion in females of *messeae* forced to take blood, since they never feed in winter under natural conditions. It is suggested that differences in the infectibility of mosquitos of the same batch may also be connected with the differences in the rate of digestion that have been observed.

Experiments showed that development of *P. vivax* in the mosquito is arrested by cold and that oöcysts are killed by a protracted sojourn at low temperatures. The effect of cold is not influenced by the stage of development of the oöcysts, but only by the duration of the exposure. Oöcysts that have died in the cold appear fairly normal until the mosquitos are placed at higher temperatures, when they begin to show clear signs of degeneration.

BARBER (M. A.), RICE (J. B.) & MANDEKOS (A.). **A Dustless Method of diluting and spreading Paris Green in Malaria Control.**—*Amer. J. Hyg.* **24** no. 1 pp. 41–44. Baltimore, Md, July 1936.

An account is given of a preliminary study of two methods of distributing Paris green against Anopheline larvae by mixing it with kerosene at a dilution in which the latter does not act as a larvicide but as a vehicle for spreading the Paris green and keeping it afloat. With the first method the larvicide is taken to the field in small receptacles containing 10 gm. Paris green in 20 cc. kerosene, and each unit is thoroughly mixed on the spot with 250 volumes of water from the breeding place and applied by spraying. As the mixture tends to settle, it should be kept agitated during the spraying. The spray cloud may be applied in the same way as a dust cloud, by projecting it either directly downwards (a procedure useful for small pools) or upwards into the air, to form a fine mist that may be carried by the wind over a wide area. The results obtained in many field experiments carried out under varied conditions seem to be as good as those in which the Paris green was diluted with road dust. This method has the advantage that the diluent does not have to be stored or transported, very little of the Paris green is lost by sinking, as it is kept afloat by the kerosene, the mixture can be applied in any weather, provided that it is not actually raining (as in other methods of spreading, the best results are obtained immediately after rain, for rain tends to free the surface of the water from scum or débris likely to prevent the free circulation of the larvicide), and there is no dust left on the surface of the water to block the feeding of the larvae, a fact that may help to explain why in the authors' experiments very little Paris green was necessary. The small amount of kerosene soon evaporates or becomes dispersed.

In the second method, the undiluted mixture of Paris green and kerosene in the proportions given is well shaken and poured over gravel, pebbles, etc., which are then broadcast over the breeding area. When the pebbles strike the water, the mixture remains on the surface and spreads over a considerable area. Castor oil at the rate of 1 or 0·5 per cent. has usually been added to the mixture to ensure spreading, but it is doubtful whether this is necessary in warm weather. The method has only been used in ponds, where it seems to be very effective.

Barber (M. A.). **Degeneration of Sporozoites of the Malaria Parasite in Anopheline Mosquitoes in Nature and its Relation to the Transmission of Malaria.**—*Amer. J. Hyg.* **24** no. 1 pp. 45–56, 1 pl., 6 refs. Baltimore, Md, July 1936.

The following is largely taken from the author's summary : A study was made of the degeneration of malaria parasites (chiefly sporozoites as they occur in the salivary glands) in nature in *Anopheles sacharovi*, Favr (*elutus*, Edw.), *A. superpictus*, Grassi, and *A. maculipennis*, Mg., collected in Greek Macedonia and in the first two collected in Cyprus, in the course of the 4 years, 1932–35. Degeneration, as judged by morphology, refringency and reaction to stains, was definitely more common in *A. superpictus* than in *A. sacharovi*. The numbers of positive examples of *A. maculipennis* were too small for adequate comparison. In a series of Anophelines infected in the laboratory, it was found that degeneration may occur among comparatively young sporozoites and at temperatures prevailing in summer ; it occurred among sporozoites of *Plasmodium vivax* in *A. superpictus* and *A. maculipennis* and among those of *P. falciparum* in all three Anophelines. *A. superpictus* again appeared to be the species in which sporozoites were most subject to degeneration. In Cyprus, degeneration was very common in this species during hot and dry weather (July 1935). In one salivary gland or lobe of a gland sporozoites in one stage of degeneration may be found, whereas in another gland or lobe they may be normal or in a different stage. The age of the sporozoites, degree of temperature or humidity, species of mosquito, species of *Plasmodium*, or food of the mosquito after infection, may be factors causing degeneration, but none seems indispensable. Epidemiological studies in Macedonia and Cyprus indicate that degeneration of sporozoites may help to explain the relative inability of *A. superpictus* to transmit malaria, an inability especially marked in some parts of Macedonia. Capsules were observed on sporozoites, both among those that had degenerated and those that were apparently normal.

Stratman-Thomas (W. K.) & Baker (F. C.). *Anopheles barberi* **Coquillet, as a Vector of** *Plasmodium vivax* **Grassi and Feletti.**—*Amer. J. Hyg.* **24** no. 1 pp. 182–183. Baltimore, Md, July 1936.

Six females of *Anopheles barberi*, Coq., reared in September 1935 from larvae collected from tree-holes in the vicinity of Ithaca, New York, were given opportunities to feed on a man infected with *Plasmodium vivax*. The two that engorged were allowed to feed 11–14 days later on another man, who subsequently developed malaria. One of the mosquitos harboured numerous sporozoites in the salivary glands and many oöcysts on the stomach ; no parasites were observed in the other.

Bishop (E. L.). **Malaria-Control Activities of the Tennessee Valley Authority.**—*Publ. Hlth Rep.* **51** no. 29 pp. 970–975. Washington, D.C., 17th July 1936.

The Tennessee Valley Authority, which is in charge of the improvement in navigation, land reclamation, flood control, and power production in the valley of the Tennessee River, has planned measures to prevent the breeding of Anophelines and the transmission of malaria along the 2,300 miles of shore-line of its reservoirs [*cf. R.A.E.*, B **24** 130]. In the present paper an account is given of the work of the health section of the Authority and the way in which it is co-operating with the other sections and with Federal organisations, State and local health departments, etc., to plan and carry out measures on a regional basis.

Lane (J.). **Notas sobre Culicideos de Rifaina.**—*Rev. Biol. Hyg.* **6** no. 2 pp. 74–78, 1 map, 5 refs. S. Paulo, December 1935. [Recd. September 1936.]

In August 1935 (dry season) the author collected a number of mosquitos attracted to man in the district of Rifaina in the State of São Paulo. The Anophelines were *Anopheles lutzi*, Cruz, *A. tarsimaculatus*, Goeldi, *A. strodei*, Root, *A. bachmanni*, Petrocchi, *A. darlingi*, Root, and *A. albitarsis*, Arrib. Larvae of *A. argyritarsis*, R.-D., were found in breeding places, but no adult was taken.

Giaquinto Mira (M.). **La malaria en Guatemala. Estudios epidemiológicos y desarrollo de la campaña antipaludica.** [Malaria in Guatemala. Epidemiological Studies and the Development of the anti-malarial Campaign.]—54 pp., 4 figs., 3 graphs. Rome, Ediz. Riv. Malariol., 1936.

This is a report of the work of a section for the study and control of malaria established in Guatemala in 1929. Investigations on the Anopheline fauna showed that *Anopheles albimanus*, Wied., is the most dangerous vector, being found not only in very malarious localities, but also in all those where there is a high percentage of severe cases due to *Plasmodium falciparum*. It is very abundant in the low coastal regions, and has extended its distribution to altitudes of about 3,600 ft. or more where conditions of temperature, humidity and breeding places are very different. At Champerico, almost all collections of fresh water disappear during the long dry season, but the females retire to crab-holes in which some water remains, and do not continue egg maturation until the rains set in. Oviposition then takes place where the brackish water is being diluted. The generations follow each other until the dry season, when the older larvae complete development in water of which the salinity increases daily to a point that inhibits development of newly hatched larvae.

A. pseudopunctipennis, Theo., is the other very common species having a very wide distribution. It is typical of high regions [*R.A.E.*, B **20** 269] and specially suited to the conditions in the plateaux. The larvae are abundant in the lakes of volcanic origin and in bogs and pools formed in the rainy season, as they can develop in muddy water with very scanty vegetation. In the dry season, which is also the coldest at high altitudes, many of the females appear fairly fat and contain

neither blood nor mature eggs. It seems certain, however, that hibernation usually occurs in the larval stage, as many larvae (especially in the second and third instars) were found from November to January, together with a few pupae. In February, at the beginning of the warm weather, larval development is intensified and the females become more active. Development from egg to adult requires 37 days in February–March and 14–20 days from May to October. In Guatemala this species is the chief vector at high altitudes and seems able to transmit *P. vivax* better than *P. falciparum* [*loc. cit.*].

A. argyritarsis, R.-D., has been found in all localities where *A. albimanus* occurs, but is always less abundant in the lowest localities. Its importance as a vector is probably greater in high localities than in low ones.

A. hectoris, Giaquinto [**24** 96] was found in three districts, all between 4,300 and 5,100 ft., and attacked man. Its habits resemble those of *A. pseudopunctipennis*, but the larvae can also develop in troughs and wells. They occur in muddy water and have not been observed in lakes. In its restricted area of distribution it must certainly be dangerous, for it was the only species found in a place where an epidemic of malaria occurred, and it has been infected experimentally.

A. vestitipennis, D. & K., is a sylvan species limited to low regions and has been taken on the Atlantic and Pacific coasts. Though not considered dangerous as regards malaria, it was found leaving the forest to attack man in houses. *A. apicimacula*, D. & K., is also sylvan, but occurs at high altitudes as well as low ones. In the literature it is not regarded as dangerous, but in some coffee plantations larvae were found in pools outside the forest and close to houses where some adults attacked man. *A. eiseni*, Coq., breeds in holes in rocks and trees and is unimportant. It has been found in two departments of the republic.

All breeding places found within two or three thousand yards of inhabited localities were dusted with Paris green and inspected periodically, and the number of breeding places with fourth-instar larvae was thus very greatly reduced.

WIGGLESWORTH (V. B.). **Malaria in Ceylon.**—*Asiatic Rev.* July 1936 reprint 9 pp., 2 pls. London, 1936.

The author gives a brief account of the outbreak of malaria that occurred in Ceylon in 1934–35. He considers that the epidemic was the result of the coincidence of several factors. In the preceding healthy years, the population had lost all immunity or tolerance to the disease [*cf. R.A.E.*, B **24** 94]. The unusual drought had caused the failure of the rice crops, so that the resistance of the population was lowered still further. The drying up of the rivers had produced conditions particularly favourable for the breeding of large numbers of the chief vector, *Anopheles culicifacies*, Giles [*cf.* **24** 92], and the short burst of rain in the autumn provided still further temporary breeding places. He considers that the application of such measures as oiling and draining in rural areas in the dry zone would be economically impracticable, and that the only possible means of control would be the development of methods of agriculture that would automatically limit the breeding of the dangerous Anopheline. It is possible to control malaria in towns, provided that there is an efficient organisation supported by legal powers ; and usually it is economically practicable on estates also. The necessity for permanent organisations in towns and

on estates in epidemic areas to prevent future outbreaks and to control the disease in inter-epidemic periods is pointed out. For rural districts and small villages in these areas, the only measure at present available is efficient treatment of the villagers.

FENG (Lan-chou). **The present Status of the Knowledge of the Mosquitoes of China and their Relation to Human Diseases.**—*Chin. med. J.* **49** no. 11 pp. 1183–1208, 6 pls., 4 pp. refs. Peiping, November 1935. [Recd. 1936.]

The author reviews from the literature the distribution of mosquitos in China and their relation to the transmission of malaria, filariasis and dengue. He disagrees with Faust [*cf. R.A.E.*, B **17** 164] as to the way in which China should be divided on the basis of its mosquito fauna. He has already shown that the Oriental Region in China extends at least as far as 30°N. lat. [**22** 104] and concludes from a study of the Culicines as well as the Anophelines that three regions should be recognised: the high land region, west of about 100°E. long., the mosquito fauna of which is almost unknown, and the low lands lying north and south of 30°N. lat., respectively, although there are certain species common to both. The plains along the Yangtsze Valley may be considered as extensions of the two regions from the north and from the south. He states that little can be said about the region to the north of 40°N. lat. except that *Anopheles maculipennis*, Mg., has definitely been found in Siberia, but so far has not been correctly recorded from Chinese territory [*cf.* **17** 164].

In north China, *A. pattoni*, Chr., *A. lindesayi* var. *japonicus*, Yamada, and *A. hyrcanus* var. *sinensis*, Wied., are found in the hilly regions, but the last-named is the only one found in the plains. In the plains along the Yangtsze Valley, *A. hyrcanus* var. *sinensis*, Wied., is the only Anopheline. In south China, the number of species of Anophelines increases from 5 in the north to 15 in the south, the commonest being *A. hyrcanus* var. *sinensis*, *A. minimus*, Theo., *A. jeyporiensis* var. *candidiensis*, Koidz., and *A. maculatus*, Theo. The important vectors of malaria would appear to be *A. pattoni* in the hilly regions of the north, *A. minimus* and *A. jeyporiensis* var. *candidiensis* in the hilly regions of the south, *A. culicifacies*, Giles, in the plateaux of Yunnan [*cf.* **23** 147], and *A. hyrcanus* var. *sinensis* in the plains throughout the country. On epidemiological grounds it would appear that *A. sacharovi*, Favr, is responsible for the transmission of malaria in Kashgar (Sinkiang).

[PAZHITNOVA (Z. A.).] **Пажитнова (З. А.). Materialien zur Erforschung der Mikrofauna der Reisfelder und die Biologie der** *Anopheles*-**Larve auf den Reisfeldern. ii. Die Microfauna der Reisfelder der Samarkander Oase.** [Material for the Investigation of the Microfauna of Rice-fields and the Biology of Anopheline Larvae in Rice-fields. ii. The Microfauna of Rice-fields of the Samarkand Oasis.] [*In Russian.*]—*Acta Univ. Asiae med.* (8a Zool.) fasc. 18 pp. 1–63, 2 pls., 9 graphs, 33 refs. Tashkent, 1935. (With a Summary in German.) [Recd. 1936.]

A detailed account is given of investigations carried out in the summer of 1928 in the Samarkand district, Uzbekistan. The physical

conditions, vegetation and microfauna of the rice-fields are discussed. Of the Anopheline larvae found, 60 per cent. were *Anopheles maculipennis*, Mg., the others being *A. hyrcanus*, Pall., and, in very small numbers, *A. pulcherrimus*, Theo., and *A. superpictus*, Grassi. Larvae of *A. maculipennis* were most abundant in late July and early September, and those of *A. hyrcanus* at the end of August and beginning of September. Experiments to ascertain the effect on the larvae of draining the fields showed that the maximum time that they could live without water was 42 hours at a mean temperature of 20°C. [68°F.], when the moisture content of the soil fell from 100 to 40 per cent. It is concluded, therefore, that control could be obtained by interrupted irrigation at intervals of 7–8 days, the fields being allowed to dry for 5 days, so that the moisture content of the soil is decreased to 30–35 per cent.

Repeated examination of different types of day-time shelters of the adult mosquitos in July and August showed that *A. maculipennis*, and to a less extent *A. superpictus*, predominated in dark quarters, and *A. pulcherrimus* and *A. hyrcanus* in those exposed to light. In the absence of domestic animals, males of all the species were more abundant, whereas females predominated in animal quarters. *A. hyrcanus*, however, chiefly sheltered during the day among the moist, dense vegetation on the banks of irrigation ditches and in the rice-fields. It reached its greatest abundance at the end of August, when it attacked man during the day.

WASFY (Omar). **A new Larvicide.**—*J. Egypt. med. Ass.* **19** no. 10 pp. 592–608. Cairo, October 1936.

Oil-refining is one of the industries of Suez. Kerosene and benzine distilled from crude oil are refined by mixing them with "oleum" [sulphuric acid containing 80 per cent. disulphuric acid], and the residue, after the removal by gravity of the refined kerosene and benzine, is known as "acid-oil-sludge." This waste product is a mixture of part of the acid used in refining the oils, some oils, and the compound sulphur and organic impurities found in the oils.

A detailed account is given of investigations on the value of this product as a mosquito larvicide. From experiments carried out in the laboratory and in the field against both Anopheline and Culicine larvae, it is concluded that it has a powerful larvicidal action (apparently due mainly to its soluble ingredients). When it was introduced into ponds at the rate of 1 part sludge to 1,000 parts water (by volume), all larvae and pupae were killed in a few hours and the ponds were free from larvae after more than a month.

As it is a waste product, it has no monetary value and can be obtained in large quantities from the refineries at Suez. It need only be applied once a month, and it does not evaporate rapidly or sink when disturbed. It is not affected by climatic changes; neither wind, which is apt to break the film of oils, nor rain, which is likely to render Paris green less effective, prevent the action of the sludge (though if rain falls within 4 hours of treatment a second application should be made). No special apparatus such as sprayers or pulverisers are needed. Although on account of the acid it contains it must be handled with care, it is not poisonous, nor is it inflammable.

MADWAR (S.). **A preliminary Note on *Anopheles pharoensis* in Relation to Malaria in Egypt.**—*J. Egypt. med. Ass.* **19** no. 10 pp. 616–617. Cairo, October 1936.

In malaria surveys carried out in Egypt in 1935, *Anopheles pharoensis*, Theo., was suspected on epidemiological grounds of being a vector. In July 1936, during an outbreak of malaria at Gabel El Asfar, dissection of 138 females of this species revealed 19 with oöcysts in the stomach and 2 with sporozoites in the salivary glands. This explains the relation of malaria to rice cultivation, for rice-fields are the preferred breeding places of *A. pharoensis*.

A. multicolor, Camb., has been considered to be a vector, but it has not been found infected in nature in Egypt, it is seldom taken in houses and does not readily bite man. The author suggests that further investigations are needed to determine whether it actually transmits the disease.

SYVERTON (J. T.) & BERRY (G. P.). **Susceptibility of the "Gopher," *Citellus Richardsonii* (Sabine), to Equine Encephalomyelitis.**—*Proc. Soc. exp. Biol. Med.* **34** no. 5 pp. 822–824, 10 refs. New York, June 1936. **An Arthropod Vector for Equine Encephalomyelitis, Western Strain.**—*Science* **84** no. 2173 pp. 186–187, 1 ref. New York, 21st August 1936.

The first paper describes experiments in infecting *Citellus richardsoni* with the western strain of the virus of equine encephalomyelitis, which suggest that this ground squirrel may serve as a reservoir of the disease in the United States. The specificity and pathogenicity to guineapigs of the virus was demonstrated after 12 successive passages through the ground squirrels. One example of the latter was refractory to the disease, possibly because it had already been infected in nature. The vector may perhaps be a tick.

The experiments described in the second paper show that the tick, *Dermacentor venustus*, Banks (*andersoni*, Stiles), can transmit the western strain of the virus to *C. richardsoni*. Eleven nymphs were placed on a guineapig immediately after it had been inoculated with brain tissue virus. They were full-fed in 48 hours. After 34 days the resultant adult ticks were placed on a ground squirrel, which died 5 days later. Brain tissue suspensions produced equine encephalomyelitis in guineapigs.

SIMMONS (J. S.). ***Anopheles* (*Anopheles*) *neomaculipalpus*, Curry, experimentally infected with Malaria Plasmodia.**—*Science* **84** no. 2174 pp. 202–203, 2 refs. New York, 28th August 1936.

This note records the experimental infection with *Plasmodium vivax* of *Anopheles neomaculipalpus*, Curry, which breeds in small collections of sunlit water in Panama, being especially common in the hoof-prints in cattle pastures. Further studies will be required to determine its importance as a vector. It is the second member of the *Arribalzagia* group to be proved susceptible to malaria infection [*cf.* *R.A.E.*, B **24** 145].

Sawyer (W. A.) & Whitman (L.). **The Yellow Fever Immunity Survey of North, East and South Africa.**—*Trans. R. Soc. trop. Med. Hyg.* **29** no. 4 pp. 397–412, 2 maps, 12 refs. London, January 1936.

The results of the mouse protection test on sera from Morocco, Algeria, Tunis, Egypt, the Anglo-Egyptian Sudan, Abyssinia, British Somaliland, Uganda, Kenya, Tanganyika, Zanzibar, Nyasaland. Northern and Southern Rhodesia, Madagascar, Bechuanaland Protectorate, the Union of South Africa and Spanish Guinea, which are given in the present paper, complete the investigation begun in 1931 and ended in 1935 on the geographical distribution of immunity from yellow fever in man in Africa [*cf.* *R.A.E.*, B **22** 173, 176 ; **23** 38, 82]. The authors, therefore, present a summary and discussion of the results obtained from the whole survey, from which the following is taken :—Immunity in man is widely but irregularly distributed in a region extending from the coast of Senegal eastward for approximately 3,300 miles to the upper reaches of the White Nile in the Anglo-Egyptian Sudan. On the north this region is limited by the Sahara Desert. On the west and south the boundary follows the coast of the Atlantic Ocean from Senegal to the extreme northern part of Angola and then runs eastward across Angola and the southern part of the Belgian Congo. The region has a maximum width of 1,400 miles and lies between latitudes 16°N. and 6°S. The few rare cases in which individuals with protective blood were found outside this region can only be explained at present by the person having (contrary to information given) visited some distant place, by sporadic infections with virus introduced into the locality or persisting there under conditions unfavourable for its spread, or by an exceptional concentration of some non-specific factor in the blood.

The region as a whole may be considered as endemic in the sense that the disease is always present and widely distributed. It may be divided into two parts, the western one, which extends to the eastern border of Nigeria and includes also the coastal region from Nigeria to Angola, and the eastern one, which covers the rest of the region. In the first, numerous epidemics of yellow fever have occurred in the past and continue to occur. The frequency of urban epidemics, in which *Aëdes aegypti*, L., is undoubtedly the vector, would make it difficult to recognise or study yellow fever perpetuated or spread in other ways. In the second, the situation is radically different. Yellow fever has never been recognised, with the exception of the single probable case recorded during the course of the immunity survey [*cf.* **23** 82]. In areas where immunity is high, the disease would appear to be continuously endemic rather than epidemic, if the epidemic disease is likely to manifest its presence by some severe and characteristic cases, as it commonly does in the western area. It is, however, possible that the strains producing the immunity may differ from those causing typical epidemics in having a lowered virulence or a selective virulence for a different set of tissues. An epidemic caused by an unfamiliar strain of altered virulence might be unrecognisable under present conditions. Within the eastern area there is a zone where the prevalence of immunity is high among children and adults ; it lies between 3 and 8°N. lat. and extends from the eastern part of the French Cameroons, across French Equatorial Africa (overlapping the northern edge of the Belgian Congo) into the Anglo-Egyptian Sudan as far as Rumbek. To the north and south

of this zone the incidence of immunity diminishes. It is suggested that studies of all aspects of the disease carried out in this area would make it possible to estimate the extent of danger from yellow fever in central Africa, the probability of its spread to the east coast, and the precautionary measures that should be adopted.

BRUMPT (E.). **Réceptivité de divers oiseaux domestiques et sauvages au parasite** (*Plasmodium gallinaceum*) **du paludisme de la poule domestique. Transmission de cet hématozoaire par le moustique** *Stegomyia fasciata*.—*C. R. Acad. Sci. Fr.* **203** no. 16 pp. 750–752, 1 ref. Paris, 1936.

The author brought fowls infected with *Plasmodium gallinaceum* from Ceylon to France and attempted to transmit the disease to other birds by inoculation. Geese, pheasants, partridges and peacocks were infected in this way, but ducks, guineafowl, pigeons, and several other kinds of birds were not susceptible. Investigations to determine the mosquito vector were negative with *Culex fatigans*, Wied., and positive with *Aëdes aegypti*, L. (*Stegomyia fasciata*, F.), the parasite being found in all of the 25 females dissected. In one, killed on the eighth day, more than 1,650 oöcysts were counted on the stomach wall. From the 12th day at 22–27°C. [71·6–80·6°F.], females of this mosquito infected fowls placed in their cage. Malaria of fowls is strictly limited to certain parts of the Far East, and the author considers that this is due to the occurrence there of wild peacocks, pheasants, geese and partridges, which were perhaps the original hosts of *P. gallinaceum*. The susceptibility to infection of these birds suggests that fowls are only an accidental host of a *Plasmodium* of wild birds with a limited geographical distribution. The parasite has not spread to other countries because the domestic fowls of Ceylon, Sumatra and Annam, where it occurs, are not exported. It is interesting that birds distantly related to fowls have been found susceptible, whereas others closely related are refractory. Geese contract serious infection that may be fatal, while ducks are immune.

NEVEU-LEMAIRE (M.). **Traité d'Helminthologie médicale et vétérinaire.**—8vo, xxiii+1515 pp., 787 figs., 4 pp. refs. Paris, Vigot Frères, 1936. Price *Fr.* 175.

This work includes a list of some 200 insect hosts of helminths, showing the worms they harbour.

GOUNELLE (H.) & RAOUL (Y.). **Action stérilisante de la chloropicrine sur les oeufs de la punaise des lits** (*Cimex lectularius* **Mer.**).—*C. R. Acad. Sci.* **203** no. 15 pp. 689–691, 1 ref. Paris, 1936.

Of 300 eggs of *Cimex lectularius*, L., 92 were kept as controls and 51 of them hatched. The remaining 208 eggs were divided into two batches and most of them fumigated with chloropicrin at concentrations equivalent to 0·5 and 1 oz. per 100 cu. ft. for 48 hours. Of these eggs 184 were left to hatch, but none did so. The remaining 24 eggs were used to test the effect of the fumigant on the pH, which was measured before and after exposure. It was found that exposure was followed by acidification of the contents of the egg, demonstrating that chloropicrin has a sterilising action on eggs of *C. lectularius*.

McKeown (K. C.). **Spider Wonders of Australia.**—8vo, xiv+270 pp., 17 pls. Sydney, Angus & Robertson Ltd., 1936. Price 6s.

This popular work includes, besides chapters on the red-back spider [? *Latrodectus hasselti*, Thorell] and the funnel-web spider (*Atrax robustus*, P.-Camb.), both recorded as causing painful bites in man, which sometimes result in death, a chapter on scorpions and one on ticks.

[Pavlovskiĭ (E. N.).] **Павловский (Е. Н.) Investigations of the Life of *Ixodes ricinus* L. in natural Conditions as a Basis for its Control.** [*In Russian.*]—*In* Pavlovskiĭ (E. N.). Ed. *Cattle Pests* pp. 22–31, 1 ref. Leningrad, Izd. Akad. Nauk SSSR, 1935. [Recd. 1936.]

Investigations in 1927–29 on *Ixodes ricinus*, L., in pasture land in the Novgorod area of the Province of Leningrad showed that cattle are infested in spring soon after they come to the pasture. The rate of infestation increases rapidly and then drops until they are practically free from ticks by the end of June. If, however, they are then driven to a fresh pasture they become reinfested, which indicates that in their absence the adult ticks are starved, probably owing to a lack of alternative hosts. No adult ticks, and only a few larvae or nymphs were found on numbers of birds examined, and the only small wild mammals of any importance as hosts were hares and hedgehogs, of which the latter were chiefly infested by larvae and nymphs. Cattle should therefore be treated by dipping or spraying [*R.A.E.*, B **17** 104; **19** 115] at intervals of 5–7 days during periods when they are liable to infestation, with a view to the ultimate elimination of the ticks from the pasture by destruction of the adults.

[Pomerantzev (B. I.).] **Померанцев (Б. И.) On the Problem of the Origin of the Breeding Grounds of Ticks in the Leningrad Province.** [*In Russian.*]—*In* Pavlovskiĭ (E. N.). Ed. *Cattle Pests* pp. 32–111, 10 figs., 7 graphs, 2 maps (1 fldg), 19 refs. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in English.) [Recd. 1936.]

With a view to evolving a system of controlling *Ixodes ricinus*, L., which is the vector of piroplasmosis of cattle in the Leningrad Province, investigations were carried out in 1930 in the Novgorod area on the seasonal incidence of the tick on animals and the type of pasture in which it occurs. An account is given of the topography of the district, the types of soil and vegetation, and the fauna. The prevalence of bovine piroplasmosis was found to be directly related to that of *I. ricinus*; both were common in the eastern, elevated part of the district, and rare in the western low-lying part. In pastures, the occurrence of ticks was invariably connected with the presence of woody vegetation. The author does not agree with Olenev that *I. ricinus* only thrives under conditions of high humidity [*R.A.E.*, B **14** 194], since, though it was widely distributed, it was most abundant in pastures that were situated on high ground and were comparatively dry. Moreover, laboratory experiments showed that high humidity is detrimental to the adult females, though they could withstand a temperature of −30°C. [−22°F.], and in the spring of 1931, large numbers of them were killed by floods from melting snow, though the eggs and larvae survived.

The only birds found to harbour the tick were those that live on the ground amongst low vegetation and grass, and even they were chiefly infested by nymphs and, to a less extent, larvae. Most of the small mammals were little infested, but larvae and nymphs were numerous on hares and especially the hedgehog (*Erinaceus europaeus*), and adults also occurred on them, being more abundant on the hares. The heaviest infestation by adult females occurred on cattle, sheep being attacked less, while horses and pigs were practically free from ticks. Cattle harboured up to 150–180 females each in May, and again in the autumn after a decrease of the infestation in mid-summer [*cf.* **17** 105].

The increased prevalence of the tick is believed to be due to the replacement of areas of virgin pine forest by pastures in which a variety of trees are allowed to grow and in which the fauna has come to include suitable hosts, such as hedgehogs. To eliminate infestation of cattle, cultivated pastures should replace the present natural ones, so as to eliminate the woody vegetation ; and any of the latter that are left should be gradually turned into forest. The cultivated pastures should be separated from infested land by fields of crops to prevent their being infested by ticks carried to them by wild hosts.

[Alfeev (N. I.).] **Алфеев (Н. И.). Distribution of *Ixodes ricinus* L. in the Region of Tsheremenetzki Lake, Leningrad Province, its Biology and Ecology.** [*In Russian.*]—*In* Pavlovskiĭ (E. N.) Ed. *Cattle Pests* pp. 111–136, 6 graphs, 1 fig., 9 refs. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in English.) [Recd. 1936.]

An account is given of investigations on the infestation of cattle by *Ixodes ricinus*, L., carried out in 1930 in the western part of the Leningrad Province. The results as regards seasonal fluctuations in infestation and its relation to different types of pasture confirm the conclusions of the two preceding papers. Wild animals were less numerous where ticks were abundant than where they were scarce. No ticks were found on most of them, but immature stages occurred on a few small rodents, and all stages, of which 36·3 per cent. were adults, on the hedgehog, *Erinaceus europaeus*. Laboratory experiments showed that partly engorged females can sometimes attach themselves to a second host and resume feeding. Ovipositing females preferred dense to sparse grass, and moss to plots devoid of vegetation. They usually sheltered in thick grass or under lumps of earth.

[Shpringgol'tz-Shmidt (A. I.).] **Шпринггольц-Шмидт (А. И.). Contributions to the Ecology and Classification of the Ixodoidea of the Far East Region.** [*In Russian.*]—*In* Pavlovskiĭ (E. N.) Ed. *Cattle Pests* pp. 137–186, 14 figs., 26 refs. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in English.) [Recd. 1936.]

A detailed account is given of a study of the ticks of the south-eastern part of the coastal zone of the Russian Far East carried out in 1929 and 1930. Only three species were found, *Ixodes ricinus*, L., *Haemaphysalis concinna*, Koch, and *Dermacentor silvarum*, Olen. A key to the larvae is given, and the larva and nymph of *D. silvarum* is described. Ticks recorded from the Russian Far East by other investigators are *I. ovatus*, Neum., *I. putus*, P.-Camb., *H. japonica douglasi*, Nutt. & Warb., and *D. variegatus* var. *kamtschadalus*, Neum., of which the last-named attacks reindeer (*Rangifer tarandus*).

Except in the south of the area, *I. ricinus* was common on cattle and horses and also attacked man ; the larvae and nymphs occurred on small mammals and birds. The ticks were particularly numerous in mixed and deciduous forests, and frequently occurred in dry habitats. The adults of *D. silvarum* were found on cattle, and sometimes on deer and wolves, but were most common on horses. Larvae and nymphs were very rare on large mammals. The distribution of the tick was not connected with any particular habitat, but with the presence of cattle and horses. On the latter, the maximum number of engorged females occurred in April–May. In the laboratory, oviposition started on 26th April. At 21–22°C. [69·8–71·6°F.] the egg stage lasted 28 days. The eggs were fairly resistant to wide fluctuations in humidity, but the larvae became more sluggish under conditions of insufficient moisture.

H. concinna is of chief importance as a pest of *Cervus hortulorum*, and was especially abundant in enclosed areas in the south where herds of this deer are kept. Up to 1,800 ticks may occur on a single animal. The males remain on the deer throughout the whole winter, chiefly on the external part of the ear. The females begin to attack them early in March when they start to graze on the southern slopes of the hills where the snow has melted, and become most abundant at the end of April and in May, when they also infest cattle, horses and other animals. They engorge in 10–20 days, and then drop to the ground and oviposit in places sheltered from the direct rays of the sun. The larvae begin to hatch in about a month and crawl on to grass stems, where they remain until there is an opportunity of attacking an animal, sometimes for as long as 180 days. During the whole summer the larvae and nymphs, as well as the adults, are abundant on the deer, but during the autumn all the females drop to the ground to hibernate. The larvae and nymphs also attack small mammals and birds. The magpie (*Pica pica*) destroys numbers of the ticks on the deer.

In laboratory observations, high or low humidity did not affect oviposition at 20–22°C. [68–71·6°F.], the preoviposition period lasted 6–7 days and the oviposition period 32, during which the female laid 3,000–5,000 eggs. The egg stage lasted 27–56 days. The activity of the larvae increased with a rise in temperature, but 47°C. [116·6°F.] was fatal to them. Larvae and nymphs engorged in 3–5 and 5 days respectively ; after engorgement the larval stage lasted 25 days and the nymphal 35. The eggs were not affected by humid or dry conditions, whereas the larvae were rather susceptible to the latter. In a humid insectary they withstood starvation for 6 months, and in a dry one for 4 months and 20 days. Unengorged adults of both sexes survived in a jar outdoors for four months from the end of October, the temperature ranging from −0·8 to −28°C. [30·6 to −18·4°F.] and then engorged normally. The duration of the life-cycle may vary from about 100 to 475 days.

[POMERANTZEV (B.) & ALFEEV (N.).] **Померанцев (Б.) и Алфеев (Н.). A Contribution to the Study of Arsenic Compounds on Ticks** *Ixodes ricinus* **L.** [*In Russian.*]—*In* PAVLOVSKIĬ (E. N.) Ed. *Cattle Pests* pp. 187–194, 6 refs. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in English.) [Recd. 1936.]

Experiments in dipping cattle to kill *Ixodes ricinus*, L. [*R.A.E.*, B **19** 115] were continued in the Novgorod area in the summer of 1929, wood

tar being added to the solutions of sodium arsenite, which contained from 0·08 to 0·19 per cent. arsenic (As_2O_3). As in the previous year, an increase in the arsenic concentration increased the rate of mortality of the ticks and reduced the fertility of the surviving females, but the dips were more effective, owing to the addition of the tar emulsions, 69·3 per cent. of the ticks being killed in 12 hours with the dip containing 0·19 per cent. arsenic. These findings were confirmed in laboratory experiments at temperatures varying from 14·5 to 25·6°C. [58·1–78°F.], and the rate of mortality increased when the treated ticks were exposed to higher temperatures, often reaching 100 per cent. when the temperature was 34·2°C. [93·5°F.]. This temperature did not increase the rate of mortality in control ticks dipped in water only.

Regular examinations of selected animals in the morning and evening showed that 96·1 per cent. of the females of *I. ricinus* that drop off the host do so during the day. Cattle should therefore be dipped in the evening, as almost all the ticks on them will then be subjected to the effect of the dip for at least one night.

[MATIKASHVILI (I. L.).] **Матикашвили (И. Л.). Materials to the Study of Endoglobular Parasites of Cattle in the Georgian Socialist Soviet Republic.** [*In Russian.*]—*In* PAVLOVSKIĬ (E. N.) Ed. *Cattle Pests* pp. 237–249, 25 refs. Leningrad, Izd. Akad. Nauk. SSSR, 1935. (With a Summary in English.) [Recd. 1936.]

An account is given of the morphology of *Piroplasma bigeminum*, *P. berberum* (*Françaiella colchica*), *Anaplasma rossicum*, *Theileria annulata*, and *T.* (*Gonderia*) *mutans*, all of which have been found in cattle in Georgia since 1929 and are transmitted by ticks, and of the symptoms and treatment of the diseases they cause. The transmission of *P. berberum* by *Boophilus calcaratus*, Bir. [*R.A.E.*, B **17** 79] was confirmed in experiments in which larvae from eggs laid by females taken on infected cattle were placed on a young bull, and the examination of its blood showed the presence of the piroplasm on the 18th day.

[OLSUF'EV (N. G.).] **Олсуфьев (Н. Г.). Materials to the Study of Tabanids of Leningrad Province.** [*In Russian.*]—*In* PAVLOVSKIĬ (E. N.) Ed. *Cattle Pests* pp. 251–316, 29 figs., 2 graphs, 1 map, 17 refs. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in English.) [Recd. 1936.]

Tabanids are very abundant in the Leningrad Province, where numerous swamps, rivers and mixed forests offer favourable conditions for their breeding. Detailed laboratory and field observations on their bionomics were, therefore, carried out in 1929–31 in a district in the central part of the former Department of Leningrad. The adults were caught with nets or collected on the surface of pools treated with crude oil or kerosene to kill them when they plunged into the water [*cf. R.A.E.*, B **17** 154]. Clusters of eggs were collected on leaves of plants on the banks of rivers and the edges of swamps, and the larvae that hatched from them were kept in jars containing sand, moss, water and pieces of earthworms as food. Attempts to induce females to oviposit in captivity were unsuccessful. Larvae were also collected from

samples of mud or moss from the bottom or edges of various accumulations of water.

Of the 27 species of Tabanids found, a list of which is given, only *Tabanus fulvicornis*, Mg., *T. tarandinus*, L., *T. tropicus*, Panz., *T. maculicornis*, Zett., *Haematopota* (*Chrysozona*) *pluvialis*, L., and *Chrysops caecutiens*, L., were abundant. Most of the species have one generation a year, but it is probable that some require two years to complete development, as larvae of all ages were found together in spring and some larvae that were full-grown in spring hibernated a second time. Pupation occurs in May or June, and the adults of the different species emerge at different times between late May and early July. The flight of the females in search of food and their attacks on animals usually begin at a temperature of not less than 16°C. [60·8°F.] and become intense at 19–20°C. [66·2–68°F.]. Sunshine and absence of wind are essential for the attack. The species of *Haematopota*, however, feed at temperatures below 16°C. as well as in dull weather and during light rain. The eggs are laid in batches on the lower surface of the leaves of plants exposed to the sun and close to water. The larvae live in moist soil, sand or moss and feed on molluscs, worms and insect larvae, and possibly on vegetable matter. As they grow, they move actively in search of food and may thus occur at a considerable distance from the place of hatching. In experiments, larvae of *Tabanus* easily withstood temperatures as low as −3°C. [26·6°F.], but most of them died when kept for 10 days at temperatures that sometimes dropped to −10·5°C. [13·1°F.].

Recently laid eggs in the outer layer of the batch were parasitised by *Telenomus tabani*, Mayr, only one parasite developing in an egg of the host, and eggs of *C. caecutiens* were parasitised by *Trichogramma evanescens*, Westw. In 1930 the percentage of eggs destroyed by one or other parasite averaged 30.

The economic importance of the Tabanids is discussed. In some localities, it is impossible to use horses on days when they are active and they considerably reduce the yield of milk from cows. It is also possible that they transmit diseases, especially anthrax [*cf.* **24** 178]. Various methods used for control are reviewed. Keeping the cattle and horses in shelter by day proved to be a valuable measure, but they had to be fed, as they did not obtain enough food on the pasture at night. Permanent control might be obtained by draining the swamps, clearing the pastures of shrubs and ploughing them, and then sowing fodder grasses.

[Blagoveshchenskiĭ (D. I.) & Pavlovskiĭ (V. N.).] **Благовещенский (Д. И.) и Павловский (В. Н.). Zur Methodik des Sammelns der Larven und der Züchtung der Oestriden-*Hypoderma* und *Gastrophilus*.** [A Method of collecting the Larvae and rearing the Adults of the Oestrids, *Hypoderma* and *Gastrophilus*.] [*In Russian.*]—*In* Pavlovskiĭ (E. N.) Ed. *Cattle Pests* pp. 317–324, 9 figs., 4 refs. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in German.) [Recd. 1936.]

In the course of investigations on *Hypoderma bovis*, DeG., infesting cattle in the Novgorod area [*R.A.E.*, B **19** 115], the authors devised a means of collecting the larvae when they left the host. The body of the

infested animal is covered with a linen case, which consists of two parts. The top part is stretched over a frame of wire covered with felt. The frame is shaped to fit close to the sides of the animal and leave a space over its back. A slit can be opened at the side to allow observations. The belly of the animal is covered with a piece of linen that is buttoned to the frame so that it sags a little. The whole is kept in position by straps. The larvae emerging from the warbles either remain in the top part of the case or make their way into its lower sagging part. Larvae from cases on cattle kept in stalls should be collected at least 3 times a day. If the infestation is slight, individual larvae can be caught in small muslin bags sown on flat rings that are glued on the skin of the animal over the warbles. The larvae collected were allowed to pupate in flower-pots filled with earth or moss and covered with muslin over a bell-shaped frame. To obtain natural conditions, pots without bottoms were sunk in the soil and covered with a portable cage.

Larvae of *Gastrophilus* about to leave horses were easily obtained by introducing the arm into the rectum of the animal and extracting them. They were reared by allowing them to pupate in flower-pots containing horse dung with a layer of soil at the bottom.

[PAVLOVSKIĬ (E. N.).] **Павловский (Е. Н.). Praktische Resultate der Vernichtung Hypodermalarven im Dorfe Semjenovschtschina (Bezirk Novgorod) und einige Bemerkungen über** *Hypoderma*. [Practical Results of the Control of *Hypoderma* Larvae in the Village of Semenovshchino (Department of Novgorod) and a few Remarks on *Hypoderma*.] [*In Russian.*]—*In* PAVLOVSKIĬ (E. N.) Ed. *Cattle Pests* pp. 325–338, 1 graph, 20 refs. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in German.) [Recd. 1936.]

Records are given of the degree of infestation of cattle by *Hypoderma bovis*, DeG., in a locality in the Novgorod area during 1927–30 [*cf. R.A.E.*, B **19** 115], and in different villages in a neighbouring district in 1929. In one village, control measures and the destruction of large numbers of larvae in experiments reduced the percentage of cattle infested from about 50 in 1929 to 14 in 1930, though 57·1 per cent. of the cattle brought from outside the village were infested in the latter year.

[PAVLOVSKIĬ (E. N.).] **Павловский (Е. Н.). Zur Ektoparasitenfauna des Leningrader Gebietes.** [On the Fauna of Ectoparasites in the Leningrad Region.] [*In Russian.*]—*In* PAVLOVSKIĬ (E. N.) Ed. *Cattle Pests* pp. 339–342. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in German.) [Recd. 1936.]

This is a list of blood-sucking Diptera and Arthropod parasites found attacking wild and domestic animals and birds in the Leningrad region in 1908–22, showing hosts and dates of capture.

In one instance large numbers of the larvae and eggs of *Lucilia caesar*, L., were found among the feathers of a moulting gosling in June, the larvae also occurring inside the quills. Many of them contained freshly ingested blood. The gosling eventually died, and since many of them do so during moulting, the cause may be infestation by the larvae of this fly.

[Pavlovskiĭ (V. N.).] **Павловский (В. Н.). Zur Ektoparasitenfauna der Haustiere im Zerawschangebiet Usbekistan.** [On the Fauna of Ectoparasites of domestic Animals in the Zeravshan Region of Uzbekistan.] [*In Russian.*]—*In* Pavlovskiĭ (E. N.) Ed. *Cattle Pests* pp. 343–355, 1 ref. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in German.) [Recd. 1936.]

Brief notes are given on a number of Diptera, lice and ticks found attacking domestic animals in central Uzbekistan during an expedition from the second half of March to the first half of June 1930.

[Tiflov (V. E.) & Pavlov (E. I.).] **Тифлов (В. Е.) и Павлов (Е. И.). Materials for the Study of the Transbaikalian Flea Fauna.** [*In Russian.*]—*Rev. Microbiol.* **15** no. 1 pp. 79–88, 4 figs., 5 refs. Saratov, 1936. (With a Summary in English.)

An examination of 1,085 fleas collected by the authors and others in 1927–32 in two localities in the eastern part of the Transbaikal region on man and animals, chiefly rodents, revealed 28 species. They are listed under their hosts, with records of the dates of capture and the numbers and sexes taken. Descriptions are given of the female of *Ceratophyllus* (*Paradoxopsyllus*) *transbaikalicus*, sp. n., both sexes of *Ctenophyllus armatus*, Wagn., and the male of *Stenoponia formozovi*, Ioff & Tiflov. The first two of these fleas were taken on *Ochonta alpina* and the third in the nest of *Microtus gregalis* ; the males of the last two were previously unknown. Attention is drawn to the fact that *Ceratophyllus* (*Oropsylla*) *silantiewi*, Wagn., which is a specific flea of *Marmota sibirica*, the chief reservoir of plague in Transbaikalia, also occurred on man, dogs, ground squirrels [*Citellus*] and the polecat, *Putorius eversmanni*.

Pearson (A. M.). **The Role of Pine Oil in Cattle Fly Sprays.**—*Bull. Del. agric. Exp. Sta.* no. 196, 63 pp., 7 figs., 39 graphs, 13 refs. Newark, Del., December 1935.

Sprays in general use in the United States at the present time for controlling flies on cattle consist of a petroleum oil base with the addition of some toxic or repellent substance such as pyrethrum, derris or pine oil. It has already been reported that pine oil increases the efficiency of mixtures of petroleum oils and pyrethrum in proportion to the amount added [*R.A.E.*, B **20** 141]. The object of the investigations here described, which were carried out in Delaware between 19th February 1934 and 30th September 1935, was to obtain quantitative data on the part played by pine oil in such sprays. Pine oil is the name given to a series of substances consisting mainly of terpene alcohols, ethers and ketones that are found in the heartwood and stumps of pine trees. Toxicity tests in the laboratory were made on reared house-flies (*Musca domestica*, L.), and the method of testing was essentially that described by Peet & Grady [**16** 255]. Repellence tests in the field were made on tethered cows by methods already described [**21** 110; **23** 167]. Among the flies in these tests, *Stomoxys calcitrans*, L., predominated, *M. domestica* was generally less abundant, and *Lyperosia* (*Haematobia*) *irritans*, L., appeared in small numbers only.

The following is taken largely from the author's conclusions : Pine oil increases (activates) the toxicity of pyrethrum extract in relation

to the amount added. The toxicity of a spray containing 1 lb. pyrethrum per U.S. gallon is maintained when 10, 15 or 25 per cent. pine oil is substituted for $\frac{1}{4}$, $\frac{1}{2}$ or $\frac{3}{4}$ lb. pyrethrum respectively. When compared with a spray containing pyrethrum alone, the three combined sprays were less expensive to manufacture, the speed with which they caused death was as great (since there was no significant increase in mortality after 24 hours), and " knockdown " (number of flies on the floor at the end of the 10 minutes' exposure) was higher. Pine oil retarded precipitation, change of colour, and loss of toxicity of pyrethrum sprays exposed to sunlight. High grade pine oils were more effective in combined sprays than those of low grade, both with regard to toxicity and to prevention of deterioration. Both the " knockdown " and the mortality produced by derris extract were increased by the addition of pine oil, the degree of increase (activation) being greater than in the case of pyrethrum. The sprays containing derris and pine oil caused death over the same period of time as a spray containing derris alone (a significant increase in mortality being observed after 24 hours). High grade pine oils were again more effective, but the differences were not so distinct as with pyrethrum. The effect of pine oil on the toxicity of a solution of rotenone crystals was similar to that on derris extract, but in concentrations as high as 25 per cent. it produced no effect on a synthetic commercial insecticide of which the main toxic ingredient was an aliphatic thiocyanate. The most satisfactory of the pine oils tested showed greater toxicity when incorporated with a base oil of low viscosity (30–35 secs. Saybolt) than with one of high viscosity (85 secs.).

The effect of the addition of pine oil to the various sprays on repellence to flies in the field was similar to its effect on toxicity. Cows sprayed with 25 per cent. pine oil in a base oil with a viscosity of 40 secs. showed no ill effects from the treatment. The repellent efficiency of this base oil alone varied from 20 to 78 per cent. ; an average of 44 per cent. was recorded in each of two series of tests. It is concluded that pine oil may be safely and economically employed in sprays against flies on cattle.

KNIPLING (E. F.). **Some Specific Taxonomic Characters of common *Lucilia* Larvae—Calliphorinae-Diptera.**—*Iowa St. Coll. J. Sci.* **10** no. 3 pp. 275–389, 2 pls., 7 refs. Ames, Iowa, April 1936.

Considerable confusion exists as to the species of *Lucilia* involved in causing myiasis of different types. The author therefore describes the three larval instars of six species of *Lucilia* commonly found in the United States, *viz.*, *L. illustris*, Mg., *L. sericata*, Mg., *L. mexicana*, Macq., *L. caeruleiviridis*, Macq., *L. cuprina*, Wied., and *L. silvarum*, Mg., and gives a key to the third-instar larvae.

KOMÁREK (J.). **Sur le problème de la myase intestinale.**—*Mém. Mus. Hist. nat. Belg.* (2) fasc. 3 pp. 23–30, 9 refs. Brussels, 1936.

An account is given of experiments which showed that larvae of *Calliphora vomitoria*, L., *Sarcophaga carnaria*, L., *Musca domestica*, L., and *Piophila casei*, L., cannot survive long unless they can obtain oxygen from the air, and that they are killed by the digestive juices of cats. The author therefore concludes that they cannot cause intestinal myiasis in man or animals or survive passage through the digestive tract.

Van Oye (P.). **Observations sur la biologie des larves de** *Simulium* (*Melusina*) **Diptère.**—*Mém. Mus. Hist. nat. Belg.* (2) fasc. 3 pp. 445–455, 11 figs., 14 refs. Brussels, 1936.

After briefly reviewing the work of others on the biology of the larvae of *Simulium* [*R.A.E.*, B **18** 212, etc.], the author describes in detail from observations in Luxemburg the method by which the larvae remain fixed in rapidly flowing water, how they move from one place to another and how they capture their food, which consists of detritus, unicellular algae and sometimes microscopic animals.

Ho (C.). **On the Blood-sucking Muscidae of Peiping.**—*Bull. Fan Mem. Inst. Biol.* **6** no. 5 pp. 185–206, 15 figs., 5 refs. Peiping, 15th January 1936. (With a Summary in Chinese.)

Descriptions and figures of the five species of blood-sucking Muscids occurring in the vicinity of Peiping are given, with a key. They are *Stomoxys calcitrans*, L., *S. indica*, Picard, *Lyperosia exigua*, de Meij., *Haematobia* (*Bdellolarynx*) *sanguinolenta*, Aust., and *H.* (*Haematobosca*) *perturbans*, Bezzi.

Smith (R. O. A.), Mukerjee (S.), Halder (K. C.) & Lal (C.). **Bionomics of** *P. argentipes*. **Part I. Duration of Life in Nature.**—*Indian J. med. Res.* **24** no. 1 pp. 295–308, 1 graph, 3 refs. Calcutta, July 1936.

Raja (K. C. K. E.). **Appendix. Duration of Life of the Sandfly** *P. argentipes* **under Laboratory Conditions and other Statistical Data.**—*T.c.* pp. 309–311.

The duration of life of *Phlebotomus argentipes*, Ann. & Brun., in nature was studied in Bengal in connection with the part it plays as a vector of kala-azar. For transmission of *Leishmania donovani* by bite, it is necessary that the sandfly live for at least 6 days after an infecting blood meal. By this time, when it is ready for its third feed, the flagellates have usually invaded the pharyngeal and buccal cavities. It was assumed, owing to its delicate structure, reluctance to fly any distance when disturbed, and tendency to remain in dark and sheltered corners of cattle sheds and living rooms and to breed in close proximity to such situations, that it does not voluntarily fly far from its breeding grounds and that a given population would be found in those sites closest to its breeding grounds that afforded food and shelter.

Wild and laboratory bred examples were marked (in most cases by dusting with fluorescein, and in others by puncturing one wing with a fine needle) and released in cattle sheds and dwellings, and the numbers recaptured after varying intervals recorded. In the first series of experiments in 1934, carried out before the advent of the monsoon, 9 flies out of 667 were taken between the 3rd and 15th day after release (no collections were made before the 3rd day). In the second series, collections were made every day from the day after release and the recovery rate for the 18 experiments was 3·6 per cent. In 16 experiments the rate of recovery varied from 0 out of 95 to 8·7 per cent. of 80 flies released ; in one of the others it was found impossible to make regular catches, and in the other 13·3 per cent. were recaptured in an experiment in which flies were released in a dwelling and only 30 were used. The marked flies recovered were all caught between the 1st and 6th day inclusive after release (the numbers being 79, 18, 9, 7, 2 and 3

respectively), although catches were continued for several days on many occasions. Since, in the experiments before the monsoon, flies had been recaptured up to the 15th day, further tests were made to determine whether flies would be recaptured if no collection was made for about 10 days after liberation ; collections were made on the 9th, 12th, 16th and 19th days, but the results were negative. It is hardly conceivable that only 3–4 per cent. of the flies present in any given situation are collected after careful search with a torch, although a fairly large proportion was probably missed by the methods used.

Flies collected from certain sheds where the experiments were carried out were classified by age. As the flies do not feed again until they have completely digested the previous blood meal and oviposited, and as this process takes approximately 3 days, those containing a full blood meal, those with a half (or more) digested meal, and those that were fully gravid without the visible presence of blood, were considered to be 1, 2 and 3 days old respectively. The proportions in which these states were found were 56, 15 and 29 per cent. respectively. A possible explanation of these proportions is that the recently fed ones were caught in some numbers because they had not yet found suitable hiding places ; those 2 days old were taken in small numbers only because most of them were already in hiding, and those 3 days old were collected in larger numbers because they were becoming active as the time for oviposition was approaching. On the assumption that only such flies as were hiding were missed, it was concluded that about 56 per cent. of the flies present in a given place were being collected. To determine whether flies migrated from the situations in which they were released, collections were made in the only house within 50 yards of a shed in which 500 flies were liberated on two occasions, but only one fly (a male) was recovered. Since the proportion of gravid flies collected from any site was in keeping with the numbers of the younger flies, breeding grounds were often found close to or inside the cattle sheds and living rooms, and no evidence of migration was obtained, the authors conclude that the flies do not migrate to any extent. The remainder of the flies liberated must, therefore, have been concealed in undiscovered hiding places or they must have been destroyed. The typical wings of *P. argentipes* were identified in the contents of the stomach and gut of lizards, and some of the spiders captured in a shed in which 1,152 flies had been released showed the test reaction for fluorescein. The web-spinning species do not, however, appear to attack them, for the sandflies take shelter on or under the webs without getting entangled in them. In two experiments in which examples of *P. papatasii*, Scop., were also released, they were recaptured in much higher proportions (in one experiment nearly 24 per cent.) than those of *P. argentipes*. The former is far more active than the latter, and it is suggested that the higher rate of recovery was due to the fact that it is better able to elude its natural enemies. From the numbers of flies collected daily in certain sheds and irregularly in others, it was found that neither the natural destruction prevailing, daily collection, nor the release of large numbers of marked flies made any appreciable difference in the numbers present. No definite conclusions are drawn from these observations but they suggest that under natural conditions a large number of sandflies are destroyed. If these findings, which were obtained in an inter-epidemic period of kala-azar, are confirmed, one reason for the slow spread of the disease would be obvious ; they indicate that under natural conditions the inoculation of flagellates

into man by a large number of sandflies is improbable. The possibility of an alteration of the balance between sandflies and their natural enemies being one of the factors responsible for epidemics of the disease is suggested.

Of 12,998 flies that took a first feed between May 1933 and September 1934, 3,337 survived till the 3rd feed about 6½ days after emergence and records were kept of the order of dying out of the 236 of these known to be infective. In the appendix these figures are used to calculate the percentages of mortality of the 3,337 flies at intervals of 2½ days (the estimated interval between successive feeds) ; from the 9th to the 24th day inclusive they are 84·97, 93·25, 96·98, 98·50, 99·24, 99·70, and 99·98. A comparison of the rates of recapture of marked flies for *P. argentipes* and *P. papatasii* showed that the difference is significant.

SMITH (R. O. A.), LAL (C.), MUKERJEE (S.) & HALDER (K. C.). **The Transmission of** *L. donovani* **by the Bite of the Sandfly** *P. argentipes*.—*Indian J. med. Res.* **24** no. 1 pp. 313–316, 2 refs. Calcutta, July 1936.

Sandflies (*Phlebotomus argentipes*, Ann. & Brun.) known to be infected with *Leishmania donovani* were fed for an average of ten times on each of 16 hamsters (*Cricetulus griseus*), one of which became infected after an incubation period of 17 months [*cf. R.A.E.*, B **19** 175 ; **22** 11]. No positive results were obtained in another series of experiments with 20 hamsters in which infected sandflies were fed once at their 5th, 6th, 7th or 8th feeds. The prolonged incubation period might have been due as much to the small number of flagellates injected as to the resistance of the hamster. In the course of the search for some factor that might have raised the resistance of the hamsters to small numbers of flagellates, it was suggested that the diet on which they were maintained in the laboratory rendered them non-susceptible by raising the adrenalin content of their blood, but from the disappointing results of attempts to transmit infection to hamsters fed on a liberal mixed diet with plenty of water, it was concluded that this is not so. As the hamster is very susceptible to infection with *Leishmania*, it is unlikely that host resistance is the cause of failure of transmission experiments. It is suggested that this should be sought in the sandfly, especial attention being paid to the presence and virulence of flagellates in the buccal cavities.

Conference of Governors of British East African Territories. Research Conferences. Conference on Co-ordination of Tsetse and Trypanosomiasis (Animal and Human) Research in East Africa held at Entebbe, 29th to 31st January 1936.—Med. 8vo, 87 pp. Nairobi, 1936.

A brief account is given of the proceedings of a conference of workers interested in research on *Glossina* and trypanosomiasis of man and animals in Uganda, Tanganyika, Kenya, the Belgian Congo and the Anglo-Egyptian Sudan. The appendices include a summary of the programme of research drawn up for 1936–37, notes on the progress made in Uganda, Tanganyika, Kenya and Nyasaland on the various subjects suggested for research at the previous conference [*R.A.E.*, B

22 169] and other subjects of interest, and a short paper by H. G. Calwell giving details of unsuccessful attempts to transmit *Trypanosoma rhodesiense* from infected to healthy guineapigs by the bites of *Glossina brevipalpis*, Newst.

ZUMPT (F.). **Der Geschlechtsapparat der Glossinen und seine taxonomische Bedeutung.** [The Reproductive Organs in *Glossina* and their taxonomic Importance.]—*Z. Parasitenk.* **8** no. 5 pp. 546–560, 13 figs., 11 refs. Berlin, 3rd August 1936.

This paper comprises a discussion of the characters of the reproductive organs of both sexes of members of the genus *Glossina* that are of importance in the identification of species, and includes a map showing the distribution in Africa of *G. palpalis*, R.-D., *G. palpalis fuscipes*, Newst., and *G. palpalis martinii*, Zumpt, the last two of which the author previously considered distinct species [*cf. R.A.E.*, B **23** 160, 250].

NINO (F. L.). **Verbreitungsgebiet der Triatomidae (Hemipt.-Heteropt.) in Argentinien und Beschreibung einer neuen Art.** [Distribution of Triatomids in Argentina and Description of a new Species.]—*Z. Parasitenk.* **8** no. 5 pp. 606–610, 2 figs., 1 ref. Berlin, 3rd August 1936.

Records are given of the local distribution of the species of Triatomids that have been found in Argentina, together with a table showing the percentage infection with *Trypanosoma* (*Schizotrypanum*) *cruzi* in *Triatoma infestans*, Klug, in various localities, and a short description of *T. rosenbuschi*, Mazza [*cf. R.A.E.*, B **24** 137].

CORSON (J. F.). **A second Note on a High Rate of Infection of the Salivary Glands of** *Glossina morsitans* **after feeding on a Reedbuck infected with** *Trypanosoma rhodesiense*.—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 2 pp. 207–212, 4 refs. London, 31st July 1936.

Work on the infection of *Glossina morsitans*, Westw., by feeding it on reedbucks infected with *Trypanosoma rhodesiense* has been continued. In an experiment carried out to act as a second control for the original test [*cf. R.A.E.*, B **23** 133], batches of laboratory bred flies were fed for 9 days on two sheep (that had been infected by the bites of flies fed on the reedbuck used in the previous experiment) and subsequently maintained on healthy sheep. The surviving flies were dissected on the 25th–27th day after the first feed on the infected sheep, and in one batch of 110 there were 3 with infected salivary glands (2·7 per cent.) and in the other batch of 50 there were none. The reedbuck used in these experiments was darker and greyer than the kind usually seen in the Tinde District and has a different native name. In December 1934, two batches of flies were fed similarly on an ordinary reedbuck that had been infected with the same strain of *T. rhodesiense* by the bite of a single example of *G. morsitans* on 25th July. Trypanosomes were present in the reedbuck's blood, but were few in number. In January 1935, the surviving flies were fed singly on rats and 2 infective flies were isolated by this means. All were then dissected and 2 out of the 32 (6 per cent.) showed infection of the salivary glands.

In February 1936, another example of the grey reedbuck was infected by the bite of a single fly with a different strain of *T. rhodesiense* (transmitted from man to sheep by *G. morsitans* during the period October–December 1934 and maintained in sheep by fly passage during 1935). Numerous polymorphic trypanosomes were present in its blood on 2nd March ; a number of flies were fed on it on 4th, 6th and 8th and subsequently maintained by daily feeds on rabbits. Of the 91 surviving flies dissected 25–28 days after the first feed, 43 (47 per cent.) showed infection of the salivary glands. The infection rates found on dissecting some of the flies used earlier to transmit this strain of trypanosome from sheep to sheep were 7·2 and 3·2 per cent. In a table are given some figures relating to the transmission of *T. rhodesiense* by *G. palpalis*, R.-D., compiled from tables published by Duke in a paper already noticed [**23** 135]. The author points out that although Duke does not give the numbers of flies that lived to the 25th day after the first feed, the rates of infection of the salivary glands are so low that if only one-fifth of the flies survived to the 25th day, the highest rate would be only 8·5 per cent.

With regard to the criticisms of his experiments by Duke [**23** 264], the author states that the blood referred to as specially suitable for the development of the trypanosomes was that of the particular reedbuck used in the experiments. He also points out that Robertson's views on the existence of an endogenous cycle of *T. gambiense* in monkeys [*cf.* **23** 228] had not been overlooked, but that so many experiments have been made in which flies have been fed daily for long periods on animals with an acute infection of *T. rhodesiense* in which numerous trypanosomes of all the well-known forms were present in the blood, that the theory of an endogenous cycle is insufficient to explain the low rates of infection of the salivary glands that have resulted.

GILKES (H.). **The Investigation of an Outbreak of Sleeping Sickness in Northern Rhodesia.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 2 pp. 213–222, 1 map. London, 31st July 1936.

An account is given of an investigation into an outbreak of sleeping sickness in a district of Northern Rhodesia known as the Hook of Kafue, where 29 microscopically diagnosed cases occurred in 1935. Daily catches of tsetse flies made regularly at various places and times revealed only *Glossina morsitans*, Westw., which appears to be distributed over almost the whole area. The association of sleeping sickness carried by this fly with buffalo is well known, and is borne out again by the fact that large herds roam through the game reserve in the north of the district.

STRICKLAND (C.) & SEN GUPTA (S. C.). **The Seasonal Infectivity of Mosquitoes as determined by a Study of the Incidence of Infantile Malaria.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 2 pp. 245–250, 4 refs. London, 31st July 1936.

The author describes a method for determining for a given locality the periods during which malaria is inoculated by the mosquito into man ; it is based on records of all infants born during the course of at least a year, with the dates of birth, and of those that suffer from malaria within a year of birth, with the dates of first attacks. If it is

assumed that the incubation period in an infant is at least 10 days, infection must have taken place at some time between birth and a date 10 days before the onset of fever.

By applying this method to data obtained from a tea estate in the North Bengal Duars, the author concludes that inoculation by the mosquito takes place certainly in the months of September, October, November and April, and at least in the alternate months of the rest of the year, possibly in every month. The chances of inoculation within 60 days of birth are shown to be considerable even during the cold weather, when the chances of infection are lowest. Further, there is little evidence to suggest that any particular season is associated with an unusually high inoculation rate or unusually long incubation periods, though there seems to be some indication that long incubation periods are most likely to occur in the cold weather (November–February).

GEBERT (S.). **The Breeding of *Anopheles costalis* in Sea-water, in Mauritius.**—*Trans. R. Soc. trop. Med. Hyg.* **30** no. 2 pp. 255–257, 2 figs. London, 31st July 1936.

On a number of occasions in Mauritius the author found *Anopheles gambiae*, Giles (*costalis*, Theo.) breeding in very brackish water. Certain pools where breeding occurred throughout the year were flooded at periods of spring tides with sea-water. The salinity of the water just after the ebb was 3·86 gm. sodium chloride per litre during periods of neap tides and 10·27 gm. during periods of spring tides. A brief account is given of experiments carried out in the laboratory, which showed that it is possible for development from egg to adult to take place in ordinary sea-water (24·55 gm. per litre) and for older larvae to give rise to adults even in the more concentrated sea-water in salt pans.

SERGENT (Et.). **Note sur les oeufs d'anophèles d'eaux saumâtres du littoral algérien.**—*Arch. Inst. Pasteur Algérie* **14** no. 2 pp. 109–118, 7 pls., 4 figs. Algiers, 1936.

The following is largely taken from the author's summary: A study was made during 1934–35 of 3,320 eggs laid in the laboratory by female Anophelines taken in stables, cow-sheds and pig-sties on farms in the vicinity of the mouths of two rivers on the coast of Algeria, in which the water was rendered brackish by admixture with the sea. *Anopheles maculipennis* var. *labranchiae*, Flni., was the most prevalent; *A. claviger*, Mg. (*bifurcatus*, auct.) was rare. The larvae of the former were present in water with a salinity of 6–9 gm. sodium chloride per litre, but disappeared when the salinity increased to 10 gm. Many of the eggs were of types intermediate between those of var. *labranchiae* and var. *sicaulti*, Roub. [*R.A.E.*, B **23** 146], so that there appears to be little to distinguish the latter from the former [*cf.* **23** 180]. No examples of *A. sacharovi*, Favr (*elutus*, Edw.) were taken, and only one batch of eggs of var. *melanoon*, Hackett [**22** 200]. The eggs of *A. claviger* are briefly described and photographs are given of them and of those of var. *labranchiae* and var. *melanoon*. *Gambusia* survived in large numbers in water with a salinity (26 gm. per litre) greater than that of sea-water (20·5–21·4 gm.).

COLLIGNON (E.) & AMBIALET (R.). **Activité des anophèles et humidité atmosphérique sur le littoral algérien.**—*Arch. Inst. Pasteur Algérie* **14** no. 2 pp. 119–122, 1 fig., 2 refs. Algiers, 1936.

Observations begun in 1934 on the relation of Anopheline activity to climatic conditions in a locality on the coast of Algeria [*cf. R.A.E.*, B **23** 249] were continued in 1935, and the results largely confirm those already obtained. Catches were only made in traps situated outside the zone in which measures against the larvae had been carried out. A reduction in humidity would appear to exert an influence on the summer decrease in activity of mosquitos apart from that due to increased temperature, but its action depends not on a continuous low rate but on sudden temporary drops. The sudden decreases in relative humidity that coincide with the beginning of the periods when the sirocco blows explain the decrease in numbers of Anophelines in their usual daytime resting places at these times [*cf. loc. cit.*], and also why certain relatively dark spots sheltered from the wind (such as culverts at ground level), which are situated near water and therefore partly escape from the effects of the lowered humidity, are used as daytime resting places in summer.

SENEVET (G.). **Les moustiques de la Martinique.**—*Arch. Inst. Pasteur Algérie* **14** no. 2 pp. 123–134, 5 figs., 11 refs. Algiers, 1936.

For about a month in July 1934, the author made a study of the mosquitos of Martinique. In the present paper, he gives notes on the species found and on those previously recorded, and a list of the species taken on the neighbouring islands, from which he compiles a list of known species and those that are likely to be found in the future. The Anophelines have already been noticed from a briefer account of his work [*cf. R.A.E.*, B **24** 158]. A new species of *Culex* is described. A map shows the distribution of malaria, which occurs in many localities, but is not severe.

CLASTRIER (J.). **Sur un cas de bouton d'orient observé dans l'Aurès (Département de Constantine).**—*Arch. Inst. Pasteur Algérie* **14** no. 2 pp. 135–136. Algiers, 1936.

An indigenous case of oriental sore is recorded for the first time from the interior of the Aurès Massif in the Department of Constantine, Algeria. Sandflies are abundant in the locality ; those taken by the author comprised *Phlebotomus papatasii*, Scop., *P. sergenti*, Parr., *P. perniciosus*, Newst., *P. ariasi*, Tonnoir, *P. minutus*, Rond., *P. fallax*, Parr., *P. parroti*, Adl. & Thdr., *P. sergenti* var. *alexandri*, Sinton, and *P. longicuspis*, Nitzu. [see next paper], of which the last two are recorded for the first time from Algeria.

PARROT (L.). **Notes sur les phlébotomes. XX.—Sur *Phlebotomus langeroni* var. *longicuspis* Nitzulescu, 1930.**—*Arch. Inst. Pasteur Algérie* **14** no. 2 pp. 137–143, 5 figs., 5 refs. Algiers, 1936. **XXI.—Sur la valve copulatrice de *Phlebotomus perniciosus* Newstead.**—*T.c.* pp. 144–147, 2 figs., 5 refs.

The sandfly described from Tunisia as *Phlebotomus langeroni* var. *longicuspis*, Nitzu. [*cf. R.A.E.*, B **19** 57], which was characterised chiefly by the form of the intromittent organ, has been found in numerous localities in Algeria (both on the coast and the High Plateaux) and

always in association with *P. perniciosus*, Newst. By rearing both sexes in the laboratory from females taken in places where both sandflies were known to occur and separating the progeny by means of the males, it was possible for the author to obtain females of both forms, and these are described in the present paper. They are extremely difficult to distinguish. As the form of the intromittent organ in the variety was constant in all the males examined, it is raised to specific rank.

From an examination of a number of males of *P. perniciosus*, Newst., from different countries, the author concludes that the terminal fork of the intromittent organ is polymorphic. In males reared from the same batch of eggs it showed numerous individual variations.

PRIDIE (E. D.). **Faits récents concernant la fièvre jaune dans le Soudan Anglo-Egyptien, en particulier la lutte contre les moustiques.**—*Bull. Off. int. Hyg. publ.* **28** no. 7 pp. 1292–1297, 1 map, 1 fldg plan, 1 ref. Paris, 1936.

Since the first case of yellow fever occurred in the Anglo-Egyptian Sudan in 1934 [*cf. R.A.E.*, B **23** 82], two suspected liver sections were obtained in 1935 from two fatal cases of icterus at El Obeid and Wad Medani in emigrants from French Equatorial Africa, and a third in January 1936 from Malakal. Inspections carried out in 1935 in many towns, including those with aerodromes, showed that *Aëdes aegypti*, L., is distributed throughout the country, although the number of breeding places varied considerably and in some places none was discovered. The aerodrome at Malakal, which, with that at Juba, was made an anti-amaryl aerodrome in 1934, was declared a sanitary aerodrome in January 1936, and has remained so, since the case suspected in January 1936 was not proved, but the measures undertaken to keep the town free from *A. aegypti* will continue to be carried out. It is considered desirable that all the principal frontier aerodromes should be made sanitary aerodromes, and it has been arranged that aeroplanes shall unload at Geneina, the westernmost one, so that they may be completely freed from insects.

Viscerotomy is now being practised so far as possible in all fatal cases of fever of unknown nature of a duration of less than 9 days. Another series of sera will be examined to fill in the gaps in the enquiry of 1934, particularly in the neighbourhood of the principal aerial routes, and the mouse protection test will be applied to rural areas to determine whether yellow fever of the "jungle" type [*cf.* **24** 34] is present in the Sudan. Information will be obtained every year on the distribution of *A. aegypti*.

VEINTEMELLAS (F.). **Le typhus exanthématique de l'"altiplano" (Bolivie).**—La Paz, September 1935. (Abstr. in *Bull. Off. int. Hyg. publ.* **28** no. 7 pp. 1377–1379. Paris, 1936.)

In the course of this paper on typhus in Bolivia, the author points out that the clothes louse [*Pediculus humanus*, L.], with which the natives are usually infested, is the principal vector of the virus from man to man, but that guineapigs, which are always found in Bolivian foci of the disease and are infested with a louse, *Trimenopon jenningsi*, Kellog & Paine, and a flea, *Hectopsylla eskeyi*, Jordan, may possibly act as a reservoir. He has succeeded in transmitting typhus to healthy guineapigs by the bites of these parasites taken from a guineapig injected with

the virus or by injecting suspensions of them. He has also proved that man is susceptible to the virus from the guineapig. Injection into guineapigs of the virus from man has enabled him to define a type of typhus, imported or indigenous, that is adapted to local conditions and that he proposes to call "altitude typhus." The guineapig is susceptible to inoculations of suspensions of lice from man, of lice and fleas from guineapigs and of lice from infected sheep. The disease produced in it is seldom fatal.

Papers noticed by Title only.

WOLCOTT (G. N.). **"Insectae Borinquenses." A revised annotated Check-list of the Insects of Puerto Rico** [including mosquitos, etc.], **with a Host-plant Index by J. I. Otero.**—*J. Agric. Univ. P. R.* **20** no. 1 pp. 1–627 (+3), 120 refs., illus. Rio Piedras, P. R., July 1936.

MORISHITA (K.). **Classification of the Formosan Anophelines, with Keys to Species** [including 14 species, with keys to the larvae as well as adults]. [*In Japanese.*]—*Trans. nat. Hist. Soc. Formosa* **26** no. 157 pp. 347–355. Taihoku, Formosa, October 1936.

SWELLENGREBEL (N. H.). **Verslag over de jaren 1934 en 1935 van de Malaria-Commissie uit den Gezondheidsraad.** [Report for 1934 and 1935 of the Malaria Commission of the Health Council of Holland (including work on *Anopheles maculipennis*, Mg.)]—*Versl. Meded. Volksgezondh.* June 1936, reprint 27 pp., 4 diagr. [Amsterdam, 1936.] [*Cf. R.A.E.*, B **24** 282–286.]

BARBER (M. A.) & RICE (J. B.). **Methods of Dissecting and Making Permanent Preparations of the Salivary Glands and Stomachs of** *Anopheles*.—*Amer. J. Hyg.* **24** no. 1 pp. 32–40, 3 figs., 2 refs. Baltimore, Md, July 1936. [Modification of previous method: *R.A.E.*, B **18** 253.]

ROMAN (E.). **Sur les premiers états (larve et nymphe) d'***Aëdes sticticus* **Meig. (Dipt. Culicidae).**—*Bull. Soc. ent. Fr.* **41** no. 10 pp. 199–202, 6 figs. Paris, 1936.

AYROSA GALVÃO (A.) & LANE (J.). **Notas sobre mosquitos de Juquiá (Estado de S. Paulo).** [Notes on Mosquitos at Juquiá in the State of S. Paulo, Brazil.]—*Rev. Biol. Hyg.* **6** no. 2 pp. 113–120, 8 figs., 9 refs. S. Paulo, December 1935. [Recd. 1936.]

LANE (J.). **Notas sobre Tabanideos.** [Records of three species including one new one from Matto Grosso, Brazil.]—*Fol. clin. biol.* **8** no. 3 pp. 70–71. S. Paulo, 1936.

PHILIP (C. B.). *Tabanus rhombicus* **and related western Horseflies.** [Including five new species and one new variety from the United States and Canada.]—*Canad. Ent.* **68** no. 7 pp. 148–160, 5 refs. Orillia, July 1936.

SCHULZE (P.). **Zwei neue** *Rhipicephalus* **und eine neue** *Haemaphysalis* **nebst Bemerkungen über Zeckenarten aus verschiedenen Gattungen.** [Two new *Rhipicephalus* (including *R. macropis* from dogs in Aden and Port Sudan) and a new *Haemaphysalis*, with Observations on Tick Species of various Genera.]—*Z. Parasitenk.* **8** no. 5 pp. 521–527, 4 figs., 14 refs. Berlin, 3rd August, 1936.

[POSPELOVA-SHTROM (M. V.).] **Поспелова-Штром (М. В.). Biological Observations on the Tick** *Hyalomma yakimovi* **Olen. in Laboratory Conditions.** [*In Russian.*]—*In* PAVLOVSKIĬ (E. N.) Ed. *Cattle Pests* pp. 195–234, 2 figs., 13 refs. Leningrad, Izd. Akad. Nauk SSSR, 1935. (With a Summary in English.) [Recd. July 1936.] [*Cf. R.A.E.*, B **21** 32.]

[ZASUKHIN (D. N.), IOFF (I. G.) & TIFLOV (V. E.).] **Засухин (Д. Н.), Иофф (И. Г.) и Тифлов (В. Е.). Materials for the Study of the Parasites and Enemies of Fleas.** [*In Russian.*] [A review of the literature, with some original records of infestation of fleas by mites.]—*Rev. Microbiol.* **15** no. 1 pp. 27–44, 15 figs., 56 refs. Saratov, 1936. (With a Summary in English.)

[TIFLOV (V.).] **Тифлов (В.). Bibliography of the Fleas of USSR** [280 titles]. [*In Russian.*]—*Rev. Microbiol.* **15** no. 1 pp. 131–141. Saratov, 1936.

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* For relation to disease see under Dengue, Encephalitis, Encephalomyelitis (Equine), Filariasis, *Hepatozoon*, Leprosy, Malaria, Yellow Fever.

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